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ISO/TC.97/SC.2
(Secr.22) **75** F/E

Décembre 1963

I S O

ORGANISATION INTERNATIONALE DE NORMALISATION
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO/TC.97/SC.2
JEUX DE CARACTERES ET CODAGE

Secrétariat:
FRANCE

Second avant-projet ISO de
CARACTERES CODES A 6 ET 7 ELEMENTS POUR L'ECHANGE D'INFORMATION
ENTRE MATERIELS DE TRAITEMENT DE L'INFORMATION

Second ISO draft proposal
6 AND 7 BIT CHARACTER CODES FOR INFORMATION
PROCESSING INTERCHANGE

UMAH 3/0/4

BRIEF HISTORY

The present Recommendation was prepared by Technical Committee ISO/TC.97, Sub-Committee 2, the Secretariat of which is held by AFNOR.

The Technical Committee began his work in 1962; draft proposals have been submitted in Paris in May 1962 by the participating Member Bodies :

France
Germany
Italy
United Kingdom
United States.

A synthesis of the various proposals was achieved and the resulting draft circulated for further discussions in October 1962.

After this meeting, the Committee ISO/TC.97 circulated, for vote and comments, the first draft proposal (as contained in document ISO/TC.97/SC.2(Secr.12)30 F/E, January 1963). A majority (7 for, 3 against, and 2 not replying) was in favour of this draft proposal (see document ISO/TC.97/SC.2(Secr.14)37).

During its meeting of October 1963, Sub-Committee 2 considered the various comments received, and this second draft proposal embodies all the agreed amendments.

By Resolution N°1 (see document ISO/TC.97/SC.2 (Secr.20)73), the ISO/TC.97 Secretariat is asked to circulate this second draft proposal to (P) and (O) members and international organizations interested, for comments to be transmitted to ISO/TC.97/SC.2 Secretariat before its next meeting (May 1964).

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INTRODUCTION

Subject

1. This Recommendation defines two character sets for general usage, including letters, figures, punctuation marks, special symbols and controls, with their coded representation.
2. The requirements for graphics and controls in data handling and programming, in accordance with computer and ancillary equipment characteristics, have been taken into account in determining these character sets.
3. This Recommendation essentially consists of two tables, complemented by notes, legend and comments.

Scope

1. These coded character sets should be used primarily for the interchange of information among data processing systems and associated equipment. They may be regarded as basic alphabets in the abstract sense.
2. These coded character sets are applicable to all so-called latin alphabets.
3. One of these sets may be used for those applications in which 6-bit characters are necessary and sufficient. The other set uses 7-bit characters which enlarges the repertoire for both the "graphics" and the "controls", especially those for interchange of information by transmitted electric signals. These two sets are compatible in that they are logically related, and this facilitates the conversion between the 6-bit and the 7-bit coded sets.

Implementation

1. These basic alphabets may be implemented in various media with logically related codes, as appropriate. For example, this could include transmission channels, punched tape and magnetic tape, and thus permit interchange of data to take place either indirectly by means of an intermediate recording in a continuous physical medium, or by local electrical connection of these various units (such as input and output devices and computers) or by means of data transmission equipment.
2. The means of encoding these character sets for transmission, for recording on physical media, and taking into account the need for error checking should be the subject of future Recommendations.

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Caractères codés pour l'échange d'information entre matériels de traitement de l'information

TABLEAU DE CODE A 6 ÉLÉMENTS D'INFORMATION

Character codes for information processing interchange

6 BIT SET TABLE

							Column				
Bits	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	Row	0	0	1	1
								0	1	2	3
	0	0	0	0	0	0	F ₀ Space	0	Null	P	
	0	0	0	1	1	1	F ₁ (HT)	1	A	Q	
	0	0	1	0	2	2	F ₂ (LF) ①	2	B	R	
	0	0	1	1	3	3	F ₃ (VT)	3	C	S	
	0	1	0	0	4	4	F ₄ (FF)	4	D	T	
	0	1	0	1	5	5	F ₅ (CR) ①	5	E	U	
	0	1	1	0	6	6	SO	6	F	V	
	0	1	1	1	7	7	SI	7	G	W	
	1	0	0	0	8	8	(	8	H	X	
	1	0	0	1	9	9	)	9	I	Y	
	1	0	1	0	10	10	*	: ②	J	Z	
	1	0	1	1	11	11	+	; ②	K	([④	
	1	1	0	0	12	12	,	< or CS ③	L	(\ ④ ⑤	
	1	1	0	1	13	13	-	= or % ③	M	(] ④	
	1	1	1	0	14	14	.	> or & ③	N	Escape	
	1	1	1	1	15	15	/	? or ' ③	O	Delete	

Caractères codés pour l'échange d'information entre matériels de traitement de l'information

TABLEAU DE CODE A 7 ÉLÉMENTS D'INFORMATION

Character codes for information processing interchange

7 BIT SET TABLE

								0	0	0	0	1	1	1	1
								0	0	1	1	0	0	1	1
								0	1	0	1	0	1	0	1
								0	1	2	3	4	5	6	7
Bits	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	Row	Column						
	0	0	0	0	0	0	0	TC ₀ (Null)	DC ₀ (DLE)	Space	0	(@) ④	P	— ⑦	p
	0	0	0	1	1	1	1	TC ₁ (SOM)	DC ₁	!	1	A	Q	a	q
	0	0	1	0	2	2	2	TC ₂ (EOA)	DC ₂	..	2	B	R	b	r
	0	0	1	1	3	3	3	TC ₃ (EOM)	DC ₃	~ # ⑧	3	C	S	c	s
	0	1	0	0	4	4	4	TC ₄ (EOT)	DC ₄ (Stop)	CS ⑥	4	D	T	d	t
	0	1	0	1	5	5	5	TC ₅ (WRU)	Error	%	5	E	U	e	u
	0	1	1	0	6	6	6	TC ₆ (RU)	Sync.	&	6	F	V	f	v
	0	1	1	1	7	7	7	TC ₇ (Bell)	LEM	'	7	G	W	g	w
	1	0	0	0	8	8	8	FE ₀ (BS)	IS ₀	(	8	H	X	h	x
	1	0	0	1	9	9	9	FE ₁ (HT)	IS ₁	)	9	I	Y	i	y
	1	0	1	0	10	10	10	FE ₂ (LF) ①	IS ₂	*	: ②	J	Z	j	z
	1	0	1	1	11	11	11	FE ₃ (VT)	IS ₃	+	; ②	K	([④	k	④
	1	1	0	0	12	12	12	FE ₄ (FF)	IS ₄	,	<	L	(\ ④ ⑤	l	④
	1	1	0	1	13	13	13	FE ₅ (CR) ①	IS ₅	—	=	M	(] ④	m	④
	1	1	1	0	14	14	14	SO	IS ₆	.	>	N	^	n	Escape
	1	1	1	1	15	15	15	SI	IS ₇	/	?	O	`	o	Delete

NOTES ABOUT THE TABLES

- ① The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and feed a line.

As an alternative, for equipment which uses a single combination (called New Line), for a combined carriage-return and line-feed operation, NL will be coded at F2 or FE 2. Then F 5 will be regarded as Backspace (BS).

If the latter type of equipment has to inter-work with the former, it may be necessary to take steps to introduce the CR character.

- ② If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of "colon" (:) and "semi colon" (;) respectively.
- ③ Either of the two alternative symbols shown in each of these positions in the table may be chosen; but this requires agreement between the sender and the recipient of the data.
- ④ "Reserved for National use". These positions are primarily intended for alphabetic extensions. If they are not required for that purpose, they may be used for symbols and the recommended choice is shown in parentheses.
- ⑤ If a second currency sign is required, it should take the place of "reverse slash" (\).
- ⑥ "Reserved for National use". Only a currency sign will be assigned to this position.
- ⑦ If an "Acknowledge" (Ack) signal is required it should be coded in this position and the "Underline" sign becomes its graphical representation.
- ⑧ Provisional note
In position 2/3 of the 7-bit set, a unique choice should be made between the preferred proposal to use tilde (~) and the second proposal to use the numbersign (#).
(This note is not intended to be included in the final Recommendation).

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LEGEND

1. Abbreviations

<u>Ack</u>	-	Acknowledge
<u>Bell</u>	-	Alarm or attention signal
<u>BS</u>	-	Backspace
<u>CR</u>	-	Carriage Return
<u>CS</u>	-	Currency Sign - For example : £ or \$
<u>DC</u>	-	Device Control
<u>DLE</u>	-	Data Link Escape
<u>EOA</u>	-	End of Address
<u>EOM</u>	-	End of Message
<u>EOT</u>	-	End of Transmission
<u>F</u>	-	Function
<u>FE</u>	-	Format Effector
<u>FF</u>	-	Form Feed
<u>HT</u>	-	Horizontal Tabulation
<u>IS</u>	-	Information Separator
<u>LEM</u>	-	Logical End of Media
<u>LF</u>	-	Line Feed
<u>NL</u>	-	New Line
<u>RU</u>	-	Are you...?
<u>SI</u>	-	Shift-in
<u>SO</u>	-	Shift-out
<u>SOM</u>	-	Start of Message
<u>Sync</u>	-	Synchronous Idle
<u>TC</u>	-	Transmission Control
<u>VT</u>	-	Vertical Tabulation
<u>WRU</u>	-	Who are you ?

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2. Graphical symbols

Position in the code tables		Names	
6-bit	7-bit		
-	2/1	!	Exclamation Mark
-	2/2	"	Quotation Mark, Diaeresis (see foot-note)
-	2/3	~	Tilde (see foot-note)
-	2/3	#	Number sign
1/13	2/5	%	Percent
1/14	2/6	&	Ampersand
1/15	2/7	'	Apostrophe, Acute accent (see foot-note)
0/8	2/8	(	Left Parenthesis
0/9	2/9	)	Right Parenthesis
0/10	2/10	*	Asterisk
0/11	2/11	+	Plus Sign
0/12	2/12	,	Comma
0/13	2/13	-	Minus Sign
0/14	2/14	.	Full Stop
0/15	2/15	/	Solidus
1/10	3/10	:	Colon
1/11	3/11	;	Semi Colon
1/12	3/12	<	Smaller than
1/13	3/13	=	Equals
1/14	3/14	>	Greater than
1/15	3/15	?	Question Mark
-	4/0	@	Commercial At
3/11	5/11	[	Left Square Bracket
3/12	5/12	\	Reverse Slash
3/13	5/13	]	Right Square Bracket
-	5/14	^	Upwards arrow, circumflex accent (see foot-note)
-	5/15	`	Grave accent (see foot-note)
-	6/0	_	Underline

Foot-note : The use of these symbols as diacritical signs is described in section 2 of the explanatory comments on the code tables.

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EXPLANATORY COMMENTS ON THE CODE TABLES

1. Numbering of the positions in the code tables

Within any one character the bits are identified by b7...b1.

If desired these may be given a numerical significance in the binary system, thus :

Bit number	b7	b6	b5	b4	b3	b2	b1
Significance	64	32	16	8	4	2	1

In the code tables the columns and rows are identified by numbers written in binary and decimal notations.

Any one position in the code table may be identified in one of three ways, thus, taking as an example numeral 1 in the 7-bit code table:

- As its bit-pattern, e.g. 011 0001
- By its column and row numbers, e.g. 3/1
- By its numerical value in the series 0 to 127, obtained by multiplying the column-number by 16 and adding the row-number, e.g. 49.

2. Diacritical Signs

It is proposed that certain printing symbols should be designed so that they may be used to permit the composition of accented letters when necessary for general interchange of information. A sequence of characters comprising a letter, the backspace and one of these symbols is needed for this composition, and the symbol is then regarded as a diacritical sign. It should be noted that these symbols take on their diacritical significance only when they are used together with the backspace; for example, the symbol corresponding to the code combination 5/14 (^) normally has the significance of upwards arrow, but becomes the diacritical sign "circumflex accent" when preceded by the backspace.

In order to increase efficiency, it is possible to introduce accented letters (as single characters) in the positions in the code tables marked by note ④.

Furthermore, according to national requirements, these positions may contain special diacritical signs, such as cedilla (¸), "háček" (ˇ) or (ʹ).

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X3.2/81
February 26, 1964

Report of Meeting No. 9, ASA Task Group X3.2.4

January 28 and 29, 1964

BEMA Headquarters, New York City

ATTENDANCE:

January

28	29	H. Spielman, Chairman	RCA
28		R. M. Armstrong (observer)	IBM
28	29	O. R. Arne	Mergenthaler Linotype
28		E. A. Avakian (observer)	Teleregister
28	29	J. B. Booth	Teletype
28	29	W. F. Emmons	IBM
28		R. F. Ewald	Bell Labs.
28	29	L. L. Griffin	Navy
28	29	J. G. Griffis (observer)	D.C.A.
28	29	W. F. Huf	Navy
28	29	R. M. Ireland	SCM Corp.
28		J. D. Keen	Univac
28	29	D. A. Kerr (observer)	Bell Labs.
28	29	W. Y. Lang	Bell Labs.
28	29	J. L. Little	NBS
28	29	C. E. Mackenzie	IBM
28	29	E. F. Manning	USAEIRD
28	29	R. F. Mundy (observer)	GSA
28	29	J. K. Nelson	Western Union
28		F. W. Smith	Western Union
28	29	R. R. Spalholz	Fairchild Graphic
28		H. Tholstrup	Friden
28	29	E. F. Vidro	Xerox
28	29	A. L. Whitman	ITT Comm. Sys.

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February 26, 1964

1. Documents 14 through 16 were distributed at this meeting:

Doc. No.	Description
X3.2.4/	
14	Zone Assignments for Escape Sequences, J. B. Booth, 3 January 1964.
15	Diagram, Interim DOD 4-Row Keyboard Using ASCII (from W. F. Huf).
16	Arguments on Motion: Place "a" above "a" and "UNDERLINE" above "A". (By Turner and Clamons, December 1963.).

- Mr. Booth reported on the X4ALE keyboard meeting of January 24, 1964, and reviewed four keyboards: (a) BEMA Standard Electric Typewriter, (b) the BEMA-ASCII keyboard of December 1963, (c) ASCII keyboard as modified by the Bell System and (d) a "Pure ASCII" keyboard.
- Mr. Griffin reviewed the X3.2 position on "underline" and acknowledge". He expressed the view that underline should preferably be associated with the upper case alphabet because of its historical association with the upper case on typewriters, and that acknowledge should serve a dual role to confirm that (a) a correct connection has been established, and (b) information has been received successfully. If a graphic response is desired to acknowledge correct connection, it should be called "graphic response" and selected from the center four columns of the ASCII.
- After discussion, a motion was made by Mr. Little, seconded by Mr. Booth to approve a resolution relating to the rejection by X3.2 at its December 1963 meeting of an X3.2.4 recommendation:

X3.2.4 reaffirms its recommendation to X3.2 of December 17 and 18, 1963 that the U. S. delegation supports for the ISO Draft Proposal that "at-sign" be in column 6, row 0 and "underline" be in column 4, row 0.

The vote was seven for, none against, one abstaining.

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The reasons are:

For:

1. @ has been proposed as an additional character reserved for national use. To reduce the number of national symbols in the center four columns the @ should be moved outside of the center four columns.
2. The French/Italian typewriter requires five lower case accented letters. Moving the @ (if reserved for national usage) allows four in the last two columns. The fifth will have to be made available from the center four columns.
3. If @ is coupled with underscore () then underscore is better placed in the center four columns because in the collapse of the lower case set with the upper case set the text would not be obliterated.

Against:

1. It is not desirable to change the ASCII except for compelling reasons.
2. If changes are required in ASCII, then all requirements should be given equal consideration, not just one of them.
3. The ISO draft proposal contains the @ at the same place as the ASCII.
5. Mr. Emmons presented IBM's ideas on controls, based upon document X3.2.4-1. There was also a brief discussion of the X3.3 letter of January 14, 1964 to X3.2 concerning controls. These discussions culminated in the following actions:

Motion by Mr. Huf, seconded by Mr. Keen.

X3.2.4 will not consider as an objective X3.3's proposal to reserve unassigned spaces within the code for control characters, and requests that X3.3 forward promptly to X3.2.4 any known needs for additional control characters.

The vote was ten for, none against, one abstaining.

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Considerable discussion ensued concerning the relative importance of existing ASCII controls versus certain proposed new controls, such as negative response, forward error, end of block, restore, polling start and device control lock, as well as the importance of shift-out and shift-in, now that lower case letters are assigned unique bit patterns. Mr. Spielman conducted a straw poll with the following results:

- (a) Move "ACK" to column 0 or 1.

The vote was seven for, none against, two abstaining.

- (b) Replace "ERR" with "NACK".

The vote was eight for, one against, one abstaining.
NACK is to be defined along the lines suggested by X3.3.4.

7. A motion was made by Mr. Emmons and seconded by Mr. Keen:

Replace "RU" with "ACK" in column 0, row 6.

The vote was seven for, none against, three abstaining.

8. A special meeting of an ad hoc group comprising interested participants of X3.2.4 and others will meet in Washington, D.C. on March 10, 1964 to explore "escape", "start stream", "end stream", "restore" and possibly "data link escape" and related problems.
9. The next regular meeting of X3.2.4 will be in Washington, D. C. on March 11, 1964.

John L. Little
Secretary, X3.2.4

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USCOMM-NBS-DC

Date: 30 & 31 January, 1964

Presiding Officer: L. L. Griffin - Chairman, Subcommittee X3.2

Time: 9:00 A.M. to 5 P.M. - 1/30/64 with recess for lunch
9:00 A.M. to 5:15 P.M. - 1/31/64 with recess for lunch

Place: BEMA Headquarters
235 E. 42 Street
New York 17, New York

RECEIVED BEMA/DPG
FEB 26 1964

1. Attendance

Those present on January 30 are listed in Appendix A-1. Those present on January 31 are listed in Appendix A-2.

2. Minutes of previous meeting

The minutes of meeting #34 were not distributed and could thus not be voted on. The following correction was added to the minutes:

Item 10.3 - Add; Vote - Yes (9), No (0), Abstain (2)

3. Membership

3.1 Mr. Spielman moved that Mr. E. A. Avakian be accepted as a member of X3.2

Vote: Yes (17), No(0), Abstain (0)

3.2 A request was made that a second alternate, Mr. H. L. Gross, be appointed for Mr. A. H. Hassan. There was discussion as to the legality of a member having more than one alternate; after some investigation it was found that there was no subcommittee precedent forbidding it. Mr. Gross was then accepted as an alternate member.

Vote: Yes (19), No (0), Abstain (0)

3.3 Mr. J. Windhorst of Control Data Corporation was proposed for membership.

Vote: Yes (18), No (0), Abstain (0)

3.4 Mr. Mendelsohn moved that Mr. H. Rathbun be accepted as an alternate member for the Monroe Calculating Machine Company.

Vote: Yes (18), No (0), Abstain (0)

3.5 A letter from J. C. Penney Company was read, requesting that Mr. R. Utman be accepted as a principal member of X3.2. Mr. A. Whitman so moved.

Vote: Yes (20), No (0), Abstain (0)

PRIVATE ASA X3 COMMITTEE DOCUMENT

3.6 It was moved that Mr. C. E. Macon of Burroughs Corporation be accepted as a principal member.

Vote: Yes (19), No (0), Abstain (0)

4. Agenda

The draft agenda as proposed by the chairman and amended by the subcommittee was adopted and is attached as Appendix B.

5. Plan for the development of a standard collating order

Mr. F. M. Delaney of X3.4.4 stated that he had been appointed by X3.4.4 to act as liaison with X3.2 in establishing a standard collating order. There was some discussion as to whether X3.2 should deal with this question and, if so, by what means. It was recommended that a task group be appointed to work on I/O media, data formats, related sets, collating sequence, programming implications, and related applications.

Mr. Utman moved that the X3.2.5 Title and Scope be changed to Data Formats, Related Sets and Applications.

Vote: Yes (19), No (1), Abstain (1)

Mr. L. L. Griffin stated that he would appoint a chairman and inform X3 and X3.4 of this action.

6. Revote on bit order of transmission

Mr. F. W. Smith moved that X3.2 reaffirm its position that bit order of transmission be low order first.

It was moved that a roll-call ballot be taken. The results of that roll-call ballot are shown in Appendix C. The numerical vote was:

Yes (13), No (9), Abstain (2)

Mr. J. Auwaerter moved that the chairman be instructed to convey the record ballot on the motion reaffirming the X3.2 position on bit order of transmission to the chairman of X3 for use by X3 at its February 6, 1964 meeting.

Vote: Yes (21), No (0), Abstain (0)

7. Plans for preparation of ASCII Design Considerations Paper for publication by ASA.

Mr. R. Utman stated that the sponsor requested that X3.2 edit the expository remarks and appendices of PASCII for publication by ASA.

R. Utman moved that the chair appoint an editing committee selected from the names listed on ASCII.

Vote: Yes (21), No (0), Abstain (0)

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3. Membership

By unanimous consent of the subcommittee, Agenda Item #3 was reopened. Mr. W. Lang moved that Mr. D. A. Kerr be accepted as an additional alternate from Bell Telephone Laboratories.

Vote: Yes (20), No (0), Abstain (0)

8. Review of Schedule of Meetings

It was moved that the March and April 1965 meeting places be interchanged.

Vote: Yes (14), No (5), Abstain (3)

The remainder of the schedule was accepted without change.

9. Reports of Task Groups

(The minutes of the Task Group meetings are attached as Appendix D)

- a) X3.2.1 - The results of the mail ballot were discussed and it was recommended that the standard be forwarded to X3 for action so that it can be taken to the ISO meetings.
- b) X3.2.2 - The revised perforated tape code standard (X3.2/16 - December 19, 1964: Proposed American Standard Perforated Tape Code for Information Interchange) has been accepted, with the vote to date being Yes (18), No (1), Abstain (0). The group has also made some changes in the Tape Reel Standard proposal and recommends it be used as a working paper at the ISO meetings.
- c) X3.2.3 - The comments received with the mail ballot on X3.2/25 - December 20, 1963: (Proposed American Standard Specification for Paper Cards for Information Processing) have been discussed and the Task Group is recommending the changes listed in X3.2/71 - January 27, 1964.
- d) X3.2.4 - ISO has proposed that Underscore () appear in Row 0, Col. 7. X3.2.4 has suggested the interchange of () as proposed and (@) which is in Row 0, Col. 5. X3.2 did not approve this change but X3.2.4 has reaffirmed its stand by a vote of Yes (7), No (4), Abstain (0).

X3.2.4 is also recommending the following changes:

1. Move ACK to Col. 1 or 2, preferably in place of RU.
2. Replace ERR by NACK.

The Task Group has decided not to accept the X3.3.4 suggestion for the disposition of certain unassigned characters. The chair asked that X3.2.4 draft a formal reply to the X3.3.4 request.

- e) X3.2.5 - There were no action items. It was agreed that the Task Group will assume new responsibilities.

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9.1 Report of Status of Numerical Control of Machine Tool papers Forwarded from TR27.2

J. Auwaerter stated that he asked EIA to reproduce some of the papers on Numerical Control of Machine Tools. This was because of a severe paperwork bottleneck in ASA. The job has not yet been done.

9.2 Report on Status of X3.2 and Task Group working papers and proposals acted on by X3.2

RS244, RS273 and RS274 have been forwarded to ISO as working papers and not as official ASA proposals.

10. Action on X3.2.1 items:

X3.2/68 - January 28, 1964 (Proposed American Standard Recorded Magnetic Tape for Information Interchange, Editorial Changes to X3.2/44, January 9, 1964) has been submitted in response to the comments received with the mail ballot on X3.2/44. Two additional actions were taken:

- a) The Task Group will draft a reply to the objections raised by Mr. T. R. Bousquet in X3.2/63 - January 27, 1964.
- b) In response to X3.2/66 - January 30, 1964, it was stated that the questions in the letter would be answered in the expository remarks on the Standard.

G. Murphy moved: Resolved - that the points raised in X3.2/66 - January 30, 1964, in support of the negative ballot have been considered in detail during deliberations on the Proposed Recorded Magnetic Tape Standard and that forwarding of the Standard not be withheld: however, that additional documentation of these discussions will be prepared in the form of "expository remarks" and forwarded to X3.

Vote: Yes (17), No (0), Abstain (0)

G. Hawkins moved: That the editorial changes noted in X3.2/68 - January 30, 1964 ("Editorial Changes to X3.2/44") as a result of comments received with the mail ballot be incorporated in X3.2/44 - January 9, 1964 ("Proposed American Standard Recorded Magnetic Tape for Information Interchange") and that the corrected document (X3.2/73 - January 31, 1964) be forwarded to X3.2 as a proposed American Standard.

Vote: Yes (17), No (0), Abstain (0)

11. Action on X3.2.2 Items

X3.2/58 - January 7, 1964 ("Proposed American Standard for Take-Up Reels for One Inch Perforated Tape") will be revised to permit detachable halves and other dimensional changes. The number of the revised document will be X3.2/70.

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Mr. J. Booth (Acting for Mr. J. Auwaerter) moved the following:

- a) That X3.2 accept X3.2/70 as a working paper for the ISO meetings.

Vote: Yes (18), No (0), Abstain (0)

- b) That X3.2/72 ("Proposed American Standard for Positions of Printed Characters on Punched Paper Tape") be accepted as an information paper for the ISO meetings.

Vote: Yes (17), No (0), Abstain (0)

- c) That X3.2 approve EIA RS291 for submission as a working paper for the ISO meetings.

Vote: Yes (17), No (0), Abstain (0)

- d) That X3.2 favors the standardization of one inch paper tape.

If ISO moves to standardize 11/16" tape, X3.2 will support the specifications of EIA RS291.

Vote: Yes (17) No (0), Abstain (0)

During the discussion of X3.2.2 action items the problem of X3.2 representation at the ISO meetings was brought up. J. Auwaerter recommended that they be the chairmen of the respective Task Groups and that Mr. L. L. Griffin be the chief delegate.

The following people were suggested as Task Group representation at:

- 1) TC97/SC4 - C. L. Mackenzie
G. Spector
R. E. Mullendore
J. L. Tobin
R. N. Eichorn
- 2) TC95/SC8 - J. F. Auwaerter
J. R. Lakin
R. Dilling
H. Tholstrup
R. F. Ewald
R. H. Hunter
E. Kettnick
D. Schneider (EIA)

The following were suggested as advisers to the United States National Committee for the IEC on 53D:

G. Murphy
H. Templeton
V. L. Thompson
E. Clamons

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12. Action on X3.2.3 Items

Mr. E. Clamons moved: That the changes recommended in X3.2/74 - January 30, 1964 ("Proposed Amendment to X3.2/25 - December 20, 1963") par. I not be included in X3.2/25 ("Proposed American Standard Specification for Paper Cards for Information Processing").

Vote: Yes (9), No (3), Abstain (2)

Mr. W. McKenzie moved: That the discussion of X3.2/74, par. I be reopened.

Vote: Yes (8), No (5), Abstain (0)

Mr. C. Mackenzie moved that X3.2/74, par. I be changed to read as follows:

1. Two sentences should be added to the Scope to read: "This standard is intended to apply to cards in which the primary method of recording information is by punched holes. This standard is not intended to exclude the use of such cards in other applications."

Vote: Yes (14), No (0), Abstain (1)

Mr. C. Mackenzie moved that the first sentence of the Scope of X3.2/25 be modified to read as shown in X3.2/74 par. V.

Vote: Yes (13), No (2), Abstain (0)

Mr. C. Mackenzie moved that the corrected noted in X3.2/74 par. II be made.

Vote: Yes (15), No (0), Abstain (0)

Mr. C. Mackenzie moved that X3.2 transmit X3.2/25 - December 20, 1963, as editorially corrected, to X3 as a proposed American Standard.

Vote: Yes (15), No (0), Abstain (1)

Mr. E. Clamons moved that X3.2/71 - January 30, 1964 ("Proposed Amendment to Proposed American Standard Specification for Paper Cards for Information Processing, January 27, 1964") be submitted to X3.2 members by letter ballot for vote.

Vote: Yes (16), No (0), Abstain (0)

In a departure from the action items, Mr. L. Griffin stated that he had requested that BEMA distribute documents to those on X3.2 with Observer status.

an additional action item for X3.2.2, Mr. J. Booth moved that X3.2 recommend to X3 that, based on the letter ballot to substitute X3.2/16 - December 19, 1963 ("Proposed American Standard for Paper Cards for Information Interchange") for X3.2/15 -

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February 26, 1964

December 19, 1963 as a proposed American Standard, that the substitution be made.

Vote: Yes (16), No (0), Abstain (0)

13. Action on X3.2.4 Items

A draft of a response to X3.3's letter (see Agenda Item 9d) was presented. It is as follows:

"X3.2 has received X3.3's letter of January 14, 1963, which includes a suggestion to reserve unassigned spaces within the code for control characters. X3.2 and X3.2.4 are continually reviewing all requests for allocation of control codes. As of this writing it does not appear reasonable to leave unassigned areas in the code since, as X3.3 concedes, the requests outnumber the spaces. In the interest of the earliest possible consideration X3.2 urges X3.3 to forward promptly to X3.2.4 a complete statement of needs for additional single character controls not previously forwarded." The draft was approved.

Vote: Yes (14), No (0), Abstain (0)

Moved by Mr. H. Spielman: That X3.2 recommend to X3 that the United States delegation support for the ISO draft proposal that note 4 (0) shown in Col. 4 Row 0 be placed in Col. 6 Row 0 and note 7 () be placed in Col. 4 Row 0.

Vote: Yes (7), No (7), Abstain (2)

The chairman declined to vote to break the tie so the motion did not carry.

At this point, two wire ballots on the bit order of transmission motion were received. Mr. J. Little moved: That X3.2 accept the wire ballot on bit order of transmission received from Mess'rs. Macon and Dilling.

Vote: Yes (13), No (1), Abstain (0)

With respect to the X3.2.4 recommendations that RU be replaced by ACK and ERR by NACK, Mr. Spielman felt that neither should be considered by X3.2 at this time.

Mr. G. Hawkins moved: That X3.2 recommend to X3 that X3 respond to the second ISO draft proposal "6 and 7 Bit Character Cores for Information Interchange" (97/2N5) as follows:

We approve in principal the Second Draft Proposal for an ISO Recommendation as presented, while setting forth as an appendix to this letter ballot certain comments on the Second Draft Proposal as herewith attached (Document X3.2/47 - January 2, 1964).

Vote: Yes (12), No (0), Abstain (0)

Following changes were made in X3.2/47 so as to produce the

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version of the document referred to in the motion:

- 1) Change title to read - Comments on the SECOND ISO DRAFT PROPOSAL ON 6 AND 7 BIT CHARACTER CODES FOR INFORMATION PROCESSING INTERCHANGE.
- 2) In 3.a., Change (Column 3, Row 0) to (Column 4, Row 0).
3. In Appendix A, change the introduction to read:

The United States supports the following definitions of Control Characters for the Second Draft Proposal. As a result of our continuing study of the application of certain control characters, some may be revised prior to the May, 1964 meeting.

The meeting adjourned at 5:15 P.M.

Appendix
A-1

X3.2 Meeting
January 30, 1964
Attendance

X3.2/81
February 26, 1964

Name	Affiliation	M	A	C	O
M. Mendelsohn	Monroe	x			
L. L. Griffin	Navy Dept.	x			
R. F. Ewald	B.T.L.		x		
R. M. Brown	D.O.D.	x			
H. S. White, Jr.	D.O.D.		x		
R. E. Mullendore	Bur. Census		x		
R. M. Ireland	SCM Corp.	x			
C. E. Mackenzie	IBM	x			
T. R. Bousquet	Honeywell	x			
F. W. Smith	Western Union Tel. Co.	x	x		
E. F. Vidro	Xerox Corp.	x			
E. A. Avakian	Teleregister Corp.				
D. E. Upton	Teleregister Corp.				
H. L. Gross	NCR		x		x
A. H. Hassan	NCR	x			
W. F. Huf	Navy (OPNAV-DNC)				
W. H. McKenzie	ITT/DISD		x		x
John Windhorst	Control Data	x			
J. L. Smith	IBM				x
H. Tholstrup	Friden Inc.	x			
R. F. Mundy	GSA				x
J. L. Little	NBS	x			
John W. Sage	U.S. Army				x
J. R. Lakin	IBM				x
F. M. Delaney	UNIVAC				
J. F. Auwaerter	Teletype				
H. Spielman	RCA	x			
Allen Whitman	ITT Comm. Systems	x			
D. A. Kerr	B.T.L.			x	
W. Y. Lang	B.T.L.	x			
George L. Murphy	Ampex Corp. Magnetic Tape Div.	x			
Philip G. Charest	NAVCOSACT				x
J. L. Thompson	UNIVAC				
G. V. Hawkins	IBM		x		
R. E. Uzman	J. C. Penney Co.	x			
E. V. Budde	G.E.	x			
R. M. Gryb	A.T. & T.	x			
Carl E. Schulthein	Burroughs Corp.				x

M = Member
A = Alternate
C = Consultant
O = Observer

Appendix
A-2

Subcommittee X3.2
January 31, 1964
Attendance

X3.2/81
February 26, 1964

Name	Affiliation	M	A	C	O
M. Mendelsohn	Monroe	x			
R. F. Mundy	GSA				
J. K. Nelson	Western Union				x
W. Y. Lang	B.T.L.	x			
R. F. Ewald	B.T.L.	x			
J. B. Booth	Teletype		x		
G. V. Hawkins	IBM		x		
John W. Sage	U.S. Army		x		
J. L. Little	NBS				x
W. H. McKenzie	ITT/DISD	x			
J. L. Smith	IBM		x		
H. L. Gross	NCR				x
A. L. Whitman	ITT CS		x		
T. R. Bousquet	Honeywell	x			
C. E. Mackenzie	IBM	x			
H. Tholstrup	Friden, Inc.	x			
E. F. Vidro	Xerox Corp.	x			
E. V. Budde	G.E.	x			
H. S. White, Jr.	Dept. of DEF.		x		
R. M. Brown	D.O.D.	x			
George L. Murphy	Ampex, Magnetic Tape Div.	x			
V. L. Thompson	Univac				
P. G. Charest	NAVCOSACT		x		
W. J. Craven, Jr.	NAVCOSACT				x
R. M. Gryb	A.T. & T.				x
L. L. Griffin	NMO	x			
E. A. Avakian	Teleregister	x			
D. E. Upton	Teleregister	x			
H. Spielman	RCA				x
E. H. Clamons	UNIVAC	x			

M = Member
A = Alternate
C = Consultant
O = Observer

Appendix D-4

X3.2/92
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Report of Meeting No. 10, ASA Task Group X3.2.4
Code Assignments
March 10 and 11, 1964
The Pentagon, Washington, D. C.

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Attendance:

March

10	11	H. Spielman, Chairman	RCA
	11	R. M. Armstrong (observer)	IBM
10	11	O. R. Arne	Mergenthaler Linotype
10	11	E. A. Avakian	Teleregister
10	11	J. B. Booth (alternate)	Teletype
	11	E. H. Clamons (alternate)	UNIVAC
10	11	C. J. Davis	IBM
10	11	W. F. Emmons (alternate)	IBM
10	11	E. S. Ferguson (observer)	Rockford Research Inst.
10	11	J. G. Griffis	DCA
	11	G. V. Hawkins (observer)	IBM
10	11	W. F. Huf	Navy
10	11	J. D. Keen	UNIVAC
10	11	D. A. Kerr (alternate)	BTI
10	11	W. Y. Lang	BTI
10	11	J. L. Little, Secretary	NBS
	11	C. E. Mackenzie (observer)	IBM
10	11	B. V. Magee (observer)	USAEIRDL
10	11	E. F. Manning	USAEIRDL
10	11	J. K. Nelson	WU
10	11	H. Tholstrup	Friden
	11	H. C. Umstead (alternate)	USAEIRDL
10	11	E. F. Vidro	Xerox

1. Documents 17 through 19 were distributed at this meeting:

Doc. No.	Description
X3.2.4/17	Document X3.3.4/24, Feb. 17, 1964, Exhibits I, II and III attached to X3.2.4 Agenda, dated Feb. 28, 1964.
18	Raw Data on Keyboards, Eric H. Clamons, 1/28/64.
19	Proposed Control Code Definitions, From W. F. Emmons, dated Feb. 27, 1964.

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Document 20 was mailed with the notice of a special meeting called for March 31, 1964.

20 X3.2.4 Proposed Control Code Assignment, W. F. Emmons, March 12, 1964.

2. Mr. Booth reported that X3.3 agrees to the X3.2 recommendation that no unassigned positions be left in ASCII.
3. Mr. Kerr reviewed Document 17 and X3.3.4 meeting conclusions. The X3.3.4 "Tutorial" paper is being revised to include only communication controls. The only new character requested by X3.3.4 that had not previously been requested is EOB, End of Block.
4. The remainder of the meeting was devoted to extensive discussion and voting on the control functions to be retained as single characters, their abbreviations, names, definitions, and positions in the ASCII code table, along with policy statements concerning recommendations to Subcommittee X3.2 and liaison with other ASA groups.
5. Control Code Revisions

- 5.1 It was decided to retain ESC and DEL in their present positions in Col. 7, Rows 14 and 15. It was also decided to remove the three functions RU and Information Separators S₂ and S₃ from the code table, and to move ACK from Col. 7, Row 12 into Col. 1, Row 10, and to add the new functions CNCL (Cancel) in Row 0, Col. 6 and EOB (End of Block) in Row 1, Col. 11. Certain ASCII functions in columns 0 and 1 are to be redesignated as follows:

Col.	Row	Present ASCII	New	New Name
0	1	SOM	SOA	Start of Address
0	2	EOA	STX	Start of Text
0	3	ECM	ETX	End of Text
0	5	WRU	INQ	Inquiry
0	6	RU	CNCL	Cancel
0	8	FE ₀	HKSP	Backspace
1	5	ERR	NACK	Negative Acknowledge
1	8	S ₀	SS	Start of Special Sequence
1	9	S ₁	ES	End of Special Sequence
1	10	S ₂	ACK	Acknowledge
1	11	S ₃	EOB	End of Block
1	12	S ₄	FS	File Separator
1	13	S ₅	GS	Group Separator
1	14	S ₆	RS	Record Separator
1	15	S ₇	US	Unit Separator

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- 5.2 The word "message" has been removed because of its conflicting usage, and replaced by "address" or "text" in all names and definitions.
- 5.3 The definitions given in X3.3.4/24 were accepted as given for SOA, STX(SOT), and ACK.
- 5.4 "End of Address" was changed to "Start of Text" to accommodate those cases in which this character does not follow a machine-sensible address.
- 5.5 Revised definitions were accepted as follows:
- 5.5.1 INQ (Inquiry). Add "a graphic" between "obtain" and "station" in the 3.3.4/24 definition: A character for use in data communication systems as a request for a response from a remote station. INQ. may be used as a "Who Are You?" to obtain a graphic station identification (if provided). The response to INQ should include ACK, NACK or NR.
- 5.5.2 DCO (DLE, Data Link Escape/NR, Not Ready).
- A conditioning character which will change the meaning of one or more following bit patterns. It is intended to provide supplementary control in data transmission links.
- NOTE: X3.2.4 requires a clarification of the X3.3.4 proposed definition of NR (Not Ready):
- (1) X3.2.4 feels a necessary use of this character will be to provide additional data communication controls in both first and second level control systems; e.g.: as the initiating character for a polling sequence in a full duplex multidrop first level system.
 - (2) X3.2.4 suggests the "Not Ready" function is the trivial case of DLE with no following character(s).
- 5.5.3 NACK (Negative Acknowledge). A character for use in communication systems to be transmitted by a receiving station as a negative response to the sending station.

X3.2.4 recognizes that the second definition of NACK suggested by X3.3.4 may well be a valid use of the NACK character, but feels that this definition should be held in abeyance until a supporting X3.3.4 paper is received.

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5.5.4 SS (Start of Special Sequence)

A character which is used to indicate the start of a variable length sequence of characters which have special significance or which are to receive special handling. The end of the sequence is indicated by ES, "End of Special Sequence".

5.5.5 ES (End of Special Sequence)

A character which is used to indicate the end of a special sequence started by SS, "Start of Special Sequence".

5.5.6 EOB (End of Block)

A character used in data communications to indicate the end of a block in systems that divide information for transmission (for example, to facilitate error control, burst transmission, etc.)

5.5.7 FS, GS, RS, US (File, Group, Record and Unit Separators).

X3.2.4 accepted the definitions from page 3 of X3.2.4/19 excluding the second paragraph under US.

6. It was decided to forward the revised code table assignments and definitions to X3.2 as a proposed modification to ASCII, with a recommendation that these be transmitted to ISO as a working paper, and to serve as instructions to the U. S. delegation for the May 1964 meeting of ISO/TC97/SC2, and that X3.3.4 be informed via X3.2 of the actions taken by X3.2.4. It was also recommended that X3.2 forward a statement to X3.4 (Programming Languages) informing them of actions taken with respect to the information separators.
7. A special meeting of Task Group X3.2.4 will be held at BEMA Headquarters at 9:30 a.m. on March 31, 1964 to complete the definitions for the 32 control functions now assigned to columns 0 and 1, and to define a preferred procedure for accomplishing the "RU" function which was removed from the code table, and to draft expository remarks on the changes outlined above.

John L. Little
John L. Little
Secretary, X3.2.4

bema

Data Processing Group
X3.2/92
March 23, 1964
Business Equipment Manufacturers Association
235 East 42nd Street, New York, N.Y. 10017 - MUrray Hill 7-5969

BEMA/DPG
235 E. 42nd St.
New York, N.Y. 100

SUBCOMMITTEE X3.2 - CHARACTER SETS AND DATA FORMAT

UNDER ASA SECTIONAL COMMITTEE X3 - COMPUTERS AND INFORMATION PROCESSING

MINUTES

Meeting #36 of March 12 & 13, 1964
Pentagon, Washington 25, D. C.

SUMMARY

1. Nominated Mr. R. Brown Vice-Chairman.
2. Elected Mr. Utman Assistant International Representative.
3. Established a Glossary Task Group.
4. Recognized W. McKenzie as Chairman X3.2.5.
5. Progress Reported on:
 - a. Take-up reels for paper tape.
 - b. Physical characteristics of paper tape.
 - c. Special purpose paper cards.
 - d. Twelve row punched card code.
 - e. Definitions and assignment of single character control codes.
6. Approved:
 - a. Nominations U. S. delegations to ISO and IEC for X3 approval.
 - b. Affirmed single 9-track standard for magnetic tape.
 - c. Affirmed single one inch paper tape standard.
 - d. Forwarded reply to punched card proposal from Italy.
 - e. Tentatively approved control code items for inclusion where ASCII is amended.
 - f. Vote of confidence in U. S. delegations nominees from X3.2.
 - g. Agreed to publish Proposed American Standard Recorded Magnetic Tape immediately and follow with expository remarks later.
 - h. Circulate in X3.2 Proposed American Standard Take-Up Reels for 1" Perforated Tape.

Respectively submitted,

Eric H. Clamons

Eric H. Clamons
Secretary pro tem
X3.2 Meeting #36

PRIVATE ASA X3 COMMITTEE DOCUMENT

NOT FOR PUBLICATION

X3.2/92
March 23, 1964

Minutes of Meeting #36 - Subcommittee X3.2

Date: 12 and 13 March, 1964

Presiding Officer: L. L. Griffin - Chairman, Subcommittee X3.2

Time: 9:00 A.M. to 5:00 P.M. - 3/12/64 with recess for lunch.
9:00 A.M. to 4:00 P.M. - 3/13/64 with recess for lunch.

Place: Pentagon, Room 4E442, Washington, D. C.

1. Attendance (See Appendix A)

2. Minutes of previous meetings

The minutes of meeting #34 were approved as amended in meeting #35. The following changes were made to the minutes of meeting #35:

- a) Page 3, paragraph 9(d), line 2 - Change "column 7" to "column 6".
- b) Page 3, paragraph 9(d), line 3 - Change "column 5" to read "Column 4".
- c) Page 3, paragraph 9(d), line 6, should read: X3.2.4 considered the....
- d) Page 3, paragraph 9(d), Item 1: Change "column 1 or 2" to read "column 0 or 1".
- e) Page 5, Item (1) TC-97/SC4 - Change Mr. Mackenzie's initials to C. E.
- f) Page 5, Item (2) TC-95/SC8 - Correct spelling to "E. Kettlich".
- g) Page 6, line 21 - The word "corrected" should read "correction."
- h) Page 7, Item 13, 8th line from bottom - "cores" should be "codes".
- i) Appendix F, page 1 - Harry S. White, Jr.: add Washington 25, D. C.
- j) Appendix F, page 3, column 1 - Add (X3.2.4) to J. Lewis.
- k) Appendix F, page 3, column 2 - (1) The name should be "R. F. Ewald" not "Eward". (2) Add (X3.2.5) to W. H. McKenzie.

PRIVATE ASA X3 COMMITTEE DOCUMENT

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1) Appendix F, page 8, column 2

(1) Change:

R. M. Kalb (X3.2.2)
UNIVAC, Division - Plant #4
Sperry Rand Corporation
UNIVAC Park
St. Paul 16, Minnesota
Tel: 633-6170, Ext. 423

(2) Add:

Mr. E. W. Kettlich (X3.2.2)
Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois
Tel: 312 OR-6-1000

m) Appendix F, page 9 - Add the following names and addresses:

(1) Mr. Neal Locke (X3.2.3)
Shell Oil Company
50 West 50th Street
New York 20, New York
TEL: 212 JU-6-5000

(2) Mr. J. L. Tobin (X3.2.3)
UNIVAC Division
Sperry Rand Corporation
P. O. Box 500
Blue Bell, Pa.
Tel: 215 MI-6-9000, Ext. 227

With the above additions and corrections, the minutes of meeting #35 were approved.

3. Membership

- 3.1 Mr. Erwin V. Budde of GE has resigned and has nominated Mr. James Taunt, System Eng. 409, PO 207, GE, Phoenix, Arizona, 85013, as a principal member. He holds a proxy for this meeting.
- 3.2 Mr. Ed Lohse was given a proxy by Mr. C. E. Macon by wire and was nominated to become an alternate member.
- 3.3 Mr. Doug Kerr holds a proxy for Mr. E. A. Avakian on matters pertaining to X3.2.4 and for the purpose of establishing a quorum.

4. Agenda (Appendix B)

The following additions to the agenda were approved:

- a) Under item 5, Assistant X3.2 International Representative.
- b) Under item 14, letter from Defense Supply Agency, X3.2/83.
- c) Under item 15, letter received from X3.3.
- d) Under item 20, letter received from X3.1.

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4.1 Communications Received

- a) Letter from Mr. Henriques regarding distribution of documents.
- b) Letter from X3.1.
- c) Letter from X3.3.
- d) Documents received are listed in Appendix C.

5. Vice-Chairman for X3.2

The Chairman discussed the new post of Vice-Chairman. His duties would be to share the work load and to take over some of the presently neglected areas of work, e.g., liaison with other subcommittees, glossary work, ad hoc committee work, membership - correspondence and file, and speaking engagements. Discussion centered around the intent of the appointment of a Vice-Chairman. X3 had instructed X3.2 that election of a Vice-Chairman would not set a precedence for succession nor would it allow delegation of responsibility. Mr. Utman pointed out that ASA document PR-27 Section 6.3.2(3) specifically authorizes the appointment of a Vice-Chairman.

It was moved by Mr. Mendelsohn that X3.2 requests BEMA to appoint a Vice-Chairman of X3.2 and further submits a nomination for their consideration. Passed. Y (18) N (0) A (0).

Nominations were deferred until after lunch.

It was moved by Mr. Auwaerter that X3.2 elect an Assistant International Representative.

He explained that the AIR would deal with correspondence between X3.2, X3-IAC, ASA and ISO, take part in the handling of documents and do a moderate amount of travelling. Passed. Y (18) N (0) A (0)

Nominations were deferred until after lunch.

6. Glossary work in X3.2

It was generally agreed that work on the glossaries is needed for both domestic and international work and that it is sufficiently important to warrant the establishment of a Task Group.

Mr. Auwaerter moved that X3.2 establish a Glossary Task Group. Passed. Y (17) N (0) A (2).

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Mr. Griffin will find a Chairman. He also announced the appointment of Mr. W. H. McKenzie as Chairman of the "new" X3.2.5.

7. Reports of Task Groups (Minutes are attached as Appendix D.1 to 5)

- a) X3.2.1 reported on the appointment of a delegation to IEC/53D and the Joint Working Group on Magnetic Tape: V. L. Thompson (Chief delegate), G. Murphy, W. H. McKenzie, H. Templeton, L. J. Higgins, and H. Knipmeyer (Alternate).

A reply to Document X3.2/82 was submitted. T. Bousquet accepted it as satisfactory.

- b) X3.2.2 reported on the delegation to ISO/TC-95/SC-8 and the Joint Working Group on Paper Tape: R. Dilling, J. Lakin, R. Hunter, E. Kettnich and an individual representing TR-27.2.

The Task Group reported a vote of Y (6) N (0) A (4) to forward the Proposed Standard for Take-Up Reels to X3.2.

Mr. Tholstrup's work on the physical characteristics of paper tape will require more work.

- c) X3.2.3 reported on its delegation to ISO/TC-97/SC-4: G. Spector, C. E. Mackenzie, C. Whitaker, J. L. Tobin. They have received a draft proposal for punched cards from the Secretariat (Italy), issued as X3.2/84.

- (1) In reply to X3.2/84, X3.2.3 voted not to support inclusion of two media, the style and conversion of dimensions, rounded corner cuts, and transparence for photo-electric readers.

- (2) Prepared instruction to delegates.

- (3) Reported on the vote for rounded corners: Y (13) N (3) A (3) No Vote (4). The "NO" votes can not be satisfied by editorial comments. X3.2.3 recommends that X3.2 refer the matter back to X3.2.3.

- (4) X3.2.3 has received a Special Purpose Paper Card document.

- (5) The "No Digits" row in the proposed new card code is still not resolved. Unanimity is not possible. A majority position has been established.

ND

0	1	2	3	4	5	6	7
TEZ	TE		Z	T	E	TZ	EZ

X3.2/92
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Chairman hopes to complete the standard at the next meeting.

- (6) A reply to DSA letter X3.2/83 was prepared.

- (a) The earliest publication for the new standard punched card was estimated March 1965.

- (b) The DSA should address individual equipment manufacturers or BEMA for dates when these could be furnished.

- d) X3.2.4 submitted a document, X3.2/88, for consideration as an amendment to the ASCII and for submission to ISO.

Letters to the Chairman of X3.3 regarding "NOT READY" and the Chairman of X3.4 regarding the proposed change in information separators will be sent.

- e) X3.2.5 reported the results of a short afternoon meeting which established a scope, title, agenda and priority.

ad 5. Election of Vice-Chairman and AIR

Messrs. J. Smith, J. Griffis, and R. Mundy were appointed to count the ballots for the election of a Vice-Chairman Nominee and Assistant International Representative.

Election of Vice-Chairman Nominee: R. Brown, C. E. Mackenzie, R. Utman, and G. Hawkins were nominated. Mr. Brown was elected for recommendation to X3.

Election of an Assistant International Representative: Messrs. Utman and Clamons were nominated. Mr. Utman was elected.

8. Report of X3 action on X3.2 items

The Chairman reported that all items submitted by X3.2 for publication had been accepted by X3. He also reported the results of the X3 Select Committee on Bit Order of Transmission: "The committee unanimously recommends publication of the High Order First document retroactive to March 1.

9. Reports on International meetings and proposals

A report was received on the recommendation of the International Joint Steering Committee in Milan which would transfer the responsibility of all computer activities to ISO/TC-97. New TG's to be formed by SC-4(Italy)

X3.2/92
March 23, 1964

on punched cards, chaired by the French; magnetic tape, chaired by the United States; paper tape, chaired by Italy; and Input/Output, chaired by the United Kingdom.

At this point it was agreed to depart from the agenda to enable action on matters relating to international activity.

12. Action on X3.2.1 matters

The question of what to do about a 7-track magnetic tape was brought up. The interim solution could be taken care of by either hardware or software or a combination of both.

It was moved by Mr. Clamons that document X3.2/85 and X3.2/86 be adopted.

Document X3.2/85 was amended to read as follows: (1) The United States delegation can only support a single standard: The 7-bit code on 9-track 1/2-inch magnetic tape. (II) The United States delegation cannot support representation of the 7-bit code on 7-track tape.

An editorial change to document 86 inserted the word "recorded" before "magnetic tape" in the 4th line from the bottom. The motion carried: Y (17) N (3) A (0).

13. Action on X3.2.2 items

Moved by Mr. C. E. Mackenzie that document X3.2/87 be adopted. With amendments to items 7 and 8:

- 7) Take a position of being able to support only one inch tape for.....
- 8) EIA Standard RS-291, but not for information interchange.

Motion passed: Y (17) N (3) A (0).

10. U. S. Delegates

Moved by Mr. Utman that all proposed delegates be accepted, passed: Y (17) N (0) A (0).

Moved by Mr. Auwaerter that Messrs. McKenzie, Snyder and Sluis be added to ISO/TC-97/SC-2 delegates. Passed: Y (18) N (1) A (0).

14. Action on X3.2.3 items

Moved by Mr. Utman that a statement be inserted into document X3.2/89 that the United States takes the position that the title include the words "paper card". Passed: Y (18) N (0) A (1).

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Moved by Mr. C. E. Mackenzie that X3.2 accept X3.2/89 as instructions to delegates and as comments. The amended document X3.2/89 as attached. Passed: Y (19) N (0) A (0).

Moved by Mr. C. E. Mackenzie that the United States can support for standardization only document ISO/TC-97/SC-4(USA-2)7, i.e., X3.2/76 as amended by X3. Passed: Y (14) N (5) A (0).

15. Action on X3.2.4 items

Moved by Mr. Spielman that the table and definitions, X3.2/88, be transmitted, for review and comments, to X3.3 and X3.4 as a proposed modification to ASCII, and, if unfavorable positions have not been generated, to serve as an SC-2 Working Paper for distribution at the meeting, or sooner if possible, and serve instructions to the USA delegations for the May 64 TC-97/SC-2 meetings.

The letter of transmittal should state specifically that only those controls which demand single characters should be considered as a requirement on ASCII, and that the use of Escape Sequence must be considered in the establishment of control requirements.

Proxies for Messrs. Windhorst and Avakian were recognized.

Motion passed: Y (8) N (4) A (7).

Mr. Clamons moved that the Chairman of X3.2.4 be requested to form an Ad Hoc Committee to prepare a document explaining the reason for the elimination of "RU" and to provide a recommendation for the execution of the function intended for "RU" within ASCII. Passed: Y (18) N (0) A (2).

10. U.S. Delegates

Moved by Mr. Utman that X3.2 recommend approval of the following delegation to TC-97/SC-2/WGA: D. B. Schneider, M. H. Sluis, B. T. Anderson, J. L. McKelvie; Alternates: J. K. Livingstone, E. J. Loeffler and H. E. Ankeney. Passed: Y (17) N (0) A (1).

15. Action on X3.2.4 items

In reply to the Chairman's query about the conflict created by the approval of the X3.2.4 recommended action which contradicts previous X3.2 recommended action by X3, Mr. Utman suggested a five point program.

- 1) Develop explanatory comments.
- 2) Write appropriate letters to X3.3 and X3.4.
- 3) Further action by X3.2 as required.
- 4) Submit USA Working Paper and Instructions to X3 (X3-IAC)
- 5) Present a full picture to the U. S. delegation.

Table appended in Appendix E.

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10. U. S. Delegates

Moved by Mr. Clamons that X3.2 via X3 advise the members of the delegations, that although instructions have been given, they have complete freedom to take such action as will enable them to carry out their responsibility in the best interests of the U.S.A. Passed: Y (9) N (1) A (0).

20. New Business

Mr. Griffin agreed to write a reply to the X3.1 letter.

12. Action on X3.2.1 items

It was agreed that lack of expository remarks should not hold up publication of the proposed American Standard Recorded for Magnetic Tape.

Mr. Utman's proxy was recognized.

Moved by Mr. Utman in absentia (Little) to accept X3.2/82 as a reply to T. Bousquet. Passed: Y (12) N (0) A (3).

13. Action on X3.2.2 items

Moved by Mr. Auwaerter in absentia (Booth) and subsequently amended that document X3.2/95*, Proposed American Standard Take-Up Reels for One Inch Perforated Tape, be circulated among X3.2 members for letter ballot for submission to X3 as a proposed American Standard. The document and ballot and explanatory remark will be mailed when ready; ballots are to be returned to the Chairman 30 days after mailing. Passed: Y (10) N (2) A (3).

14. Action on X3.2.3 items

Moved by Mr. C. E. Mackenzie that X3.2 direct the "Rounded Corner" document back to X3.2.3 for further study. Passed: Y (13) N (2) A (1).

Mr. C. E. Mackenzie wants direction and comments.

Chairman X3.2 directed Chairman X3.2.3 to reply to DSA giving March 65 and March 66 as upper and lower limits respectively for the adoption of a card standard by ASA.

16. Action on X3.2.5 items

Moved by Mr. Smith in loco W. McKenzie that the program of work, document X3.2/90, dated 3/12/64, developed by X3.2.5 be approved by X3.2 and

* New number assigned since the meeting.

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that the work be undertaken in the following order:

- 1) Media Data Formats
- 2) ASCII Related Sets
- 3) Collating Sequence

Amended by Mr. C. E. Mackenzie. Work on items 1, 2 and 3 shall take place at each meeting. Passed: Y (7) N (6) A (1).

An informal opinion was that item 2 should receive highest priority.

Motion as amended was tabled. Y (11) N (0) A (1).

15. Action on X3.2.4 items

Moved by H. Spielman that the Chairman X3.2 send the following letter which is a reply to the X3.3 proposal on transmission control characters to the Chairman of X3.3. Passed: Y (11) N (0) A (1).

NOTE: The letter mentioned in the motion is contained in the minutes of X3.2.4.

The meeting adjourned March 13, 1964 at 4:00 P.M.

Respectfully submitted,

Eric H. Clamons
Eric H. Clamons
Secretary, pro tem

X3.2/92
March 23, 1964

Appendix A

ATTENDANCE - X3.2 MEETING #36 - MARCH 12-13, 1964

Name	Affiliation	Status	March 12	March 13
E. H. Clamons	UNIVAC	M	X	X
D. A. Kerr	Bell Labs	A & P	X	X
H. Spielman	RCA	M	X	X
J. L. Little	NBS	M	X	X
O. R. Arne	Mergenthaler Linotype	M	X	X
R. F. Ewald	Bell Labs	A	X	X
W. Y. Lang	Bell Labs	M	X	X
George Murphy	Ampex Corp.	M	X	X
T. R. Bousquet	Honeywell	M	X	X
J. F. Auwaerter	Teletype Corporation	M	X	X
W. F. Huf	Navy	O	X	
R. E. Utman	J. C. Penny Co.	M	X	X
G. V. Hawkins	IBM Corporation	A	X	X
C. E. Mackenzie	IBM Corporation	M	X	X
J. W. Windhorst	Control Data Corp.	M	X	X
R. E. Mullendore	Bureau of Census	A	X	X
E. Lohse	Burroughs	A	X	X
H. S. White, Jr.	DOD	A	X	X
R. M. Brown	DOD	M	X	X
M. Mendelsohn	Monroe	M	X	X
W. H. McKenzie	ITT/DISD	A	X	X
E. J. Lewis	ITT/DISD	M	X	X
R. F. Mundy	GSA	O	X	X
J. W. Sage	U.S. Army	O	X	X
J. K. Nelson	Western Union	M	X	
J. E. Taunt	GE	P	X	X
V. L. Thompson	UNIVAC	A & P	X	X
H. L. Tholstrup	Friden, Inc.	M	X	
J. L. Smith	IBM Corporation	O	X	X
J. R. Lakin	IBM Corporation	O	X	
C. E. Schultheiss	Burroughs	O	X	
J. B. Booth	Teletype Corporation	A	X	X
J. G. Griffis	DCA	O	X	X
W. J. Craven, Jr.	NAVCSSACT	O	X	X
L. L. Griffin	U.S. Navy	M	X	X
E. F. Vidro	Xerox Corporation	M	X	X
J. A. Bardon	Def. Com. Ag.	O	X	
R. M. Gryb	AT & T	M		X

M = Member
A = Alternate
O = Observer
P = Proxy

Response to Second Draft Proposal
6 and 7 Bit Codes

X3.2/106

April 16, 1964

March 31, 1964

Letter Ballot concerning the Second Draft Proposal for an ISO Recommendation
laid down in document ISO/TC 97/SC 2 (Secr.-22)75 F/E

Approves as Presented

Belgium

Checkoslovakia

Spain

Sweden

Approves In Principle (Comments Given Below)

France (in process of being translated)

Italy

Poland

Switzerland

United Kingdom

United States

Opposed - None

Comments Received but no Ballot

Germany

~~Poland~~

C31 C7/3/1

Italy

point A - Italy expresses, with regard to Provisional Note No. 8, a preference for the use of the numbersign (#) in position 2/3 of the 7-bit set.

We believe that the tilde (~) should be considered as a national sign only.

point B - We feel in addition, that a re-examination of a limited number of symbols in the control portion of the code is in order at this time.

In particular, we wish to study the elements presently assigned to the following code table positions:

0/1, 0/2, 0/5, 0/6, 1/0, 1/4, 1/5, 1/7 up to and including 1/15.

A Working Paper proposing a new disposition of these code table positions will follow.

Switzerland

In principal Switzerland agrees to the present draft proposal and chooses the numbersign in position 2/3 of the set. The following reservations are made:

a) The proposal does not show sufficient compatibility of the special signs with the "upper and lower case philosophy" of typewriter-type devices. A definition of these characters which does not prevent a simple and straightforward implementation on such devices should be discussed and found.

b) The present proposal does not permit a complete solution of the accent problem in parallel printing devices. This is true for the French language, whereas for the German version the number of positions reserved for national use is sufficient. However, the Swiss national set should at the same time cover the French and the German requirements as mixed texts on documents are frequent.

We recognize that a correct solution of these special requirements is difficult to find and we therefore will wait for the position of France and eventually Germany before a final decision can be taken.

Switzerland Cont'd

c) In addition to the 6 and 7 bit sets a simple 4 bit numeric set should be defined for simple numeric data interchange. This need exists especially in the tele-metering area. The 4 bit set should contain the digits 0-9, space, +, -, asterisk, decimal point, possibly also comma. In order to facilitate translation from the 4 bit code to the full set a relocation of the latter signs in the 7 bit code from column 2 to column 3 should be considered.

U.K. (first set)

1. The U.K. has recorded a vote approving the second draft Proposal 75, in principle, subject to consideration of the comments tabulated below.
2. This is the first list of comments and another will follow in the near future. Included in the second list will be our opinion about Provisional Note 8 on which we have not yet reached a final decision.
3. We are of the opinion that too many Information Separators have been incorporated and probably four would be sufficient.
4. We suggest that consideration be given to the incorporation of the following four Separators:-

US	Unit Separator
RS	Record Separator
GS	Group Separator
FS	File Separator
5. We do not think that RU (TC) is required.
6. We think that ACK, which is covered at present by Note 7, should be transferred from Column 6 to a position somewhere in the first two Columns where the controls are concentrated.
7. We think that a control End of Block (EOB) is required and could take up a position somewhere in the first two Columns.

Although we intend to send further comments it will unfortunately not be possible for us to send them before your original closing date of 15th March.

March 31, 1964

We are, however, having meetings of our National Committee and will deal with the matter as quickly as possible.

U.K. Cont'd (2nd set of comments)

Note 8 - The U.K. prefers the numbers sign.

LEM or PEM

In our opinion, this matter could, with advantage, be reviewed closely because it seems that it should be possible to reach the required condition by the judicious use of the existing control characters.

If, after investigation, it appears that one or other of these controls is really necessary after all, then the U.K. would prefer PEM.

ACK

In our first comment we proposed that this should be transferred and we now suggest that it could be put at TC 6 in place of RU. The transference of ACK means the cancellation of Note 7 and also implies that there will be no graphical representation of ACK.

NACK

We think there is a good case for the inclusion of this control and suggest that it should be placed in column 1, row 5, instead of Error and that Error itself should be placed at IS 7.

EOB

We think there is a case for the inclusion of EOB (End of Block), and that a possible position for it would be in place of LEM.

Information Separators

In a previous comment we suggested four new separators, US, RS, GS and FS, and we consider that they should be placed at IS1, IS2, IS3, and IS4 respectively.

Commercial At If ACK is transferred with the consequent deletion of Note 7, we suggest that the commercial at sign (@) together with its Note 4 should be

March 31, 1964

U.K. Cont'd 2nd comments

interchanged with the dash sign - . We make this suggestion having in mind assistance to certain countries who may have difficulties with certain extended letters.

Reverse Slash

We suggest that the reverse slash (\) together with Note 4 5, should be deleted from column 5, row 12, and should be replaced by (CS2), meaning a second currency sign.

Page 21

The second item on page 21 relates to the Delete character. The statement says it is used for "Erase" and "Rub out" We do not think the second is correct and we suggest it should be replaced by "obliterate."

Germany & Poland to be added.

DEUTSCHER NORMENAUSSCHUSS

MITGLIED DER INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

BERLIN W15

Association Française de
Normalisation

25 Rue Notre-Dame des
Victoires

Paris (2^e) (Frankreich)

E5/97-2

March 17, 1964

ISO/TC 97/SC 2 "Character Sets and Coding"

Gentlemen,

We have pleasure in sending you the German Comments on the document ISO/TC 97/SC 2 (Secretariat-22)75. Would you kindly distribute the enclosed 50 copies to the members of the Sub-committee. Thank you in advance.

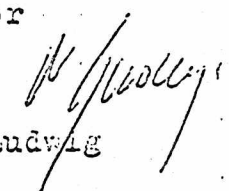
Yours faithfully

DEUTSCHER NORMENAUSSCHUSS
The Director

Encl.

Copy to

ASA


Ludwig

I S O
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
TC 97 - Computers and Information Processing
SC 2 - Character Sets and Coding
(Secretariat: France)

Deutscher Normenausschuss
Uhlandstrasse 175
Berlin 15

ISO/TC 97/SC 2 (Germany-4)
March 1964

German Comments

on Document ISO/TC 97/SC 2 (Secr.-22)75: Second ISO Draft Proposal,
6 and 7 Bit Character Codes for Information Processing Interchange

6 Bit Set

We agree in general with the 6 bit code. However, it seems to be advisable to restrict the number of possible alternatives, in particular in the places indicated by notes 3 and 5. An unique coding would facilitate information interchange in general and in international relations and would take care of the viewpoints outlined in SC 5. An unique coding would normally enable the user to use the code without previously establishing conventions about which alternative has to be selected.

We therefore propose to standardize the following arrangement:

Column/Row	Character
1/12	<
1/13	=
1/14	>
1/15	'
3/12	CS with Note 4

Should this proposal not be accepted the following alternative only should be admitted:

Column/Row	Character
1/12	OS
1/13	%
1/14	&
1/15	'
3/12	\ with Note 4

It should be explicitly stated that the two alternatives may not be combined.

7 Bit Set

According to informations received proposals will be submitted to SC 2 before or at the meeting in May from other parties which will considerable affect the control characters at present in the code table. In case that the meeting of SC 2 should decide to start a new basic discussion of the code, we propose to discuss first the set of characters to be incorporated and only after that the positions to be allocated to individual characters.

Apart from these general remarks we present the following comments on the 7 bit set table as shown in document 75:

We agree to place the small letters of the alphabet in columns 6 and 7. We propose to move the "Underline" from position 6/0 to position 4/0, it will then be nearer to the other special symbols.

Both, the Number sign and the Tilde, should be shown separately in the code. We propose to leave the Number sign in position 2/3 and to put the Tilde into position 6/0. The Commercial At should be considered as a national symbol and be placed into position 7/12 with Note 4. However, we would also be prepared to accept placing the Tilde in position 2/1 instead of the Exclamation Mark and moving this one into position 7/12.

In accordance with column 5 special signs should be allocated to the positions in column 7 marked with Note 4, when no national characters are required. The following characters are proposed with Note 4:

Column/Row	Character
7/11	↑
7/12	@ or ! (see above)
7/13	10 (base ten)

In the control area RU and at least two Information Separators could be eliminated. In their place we propose to introduce

EOB (End of Block) to be used in data transmission to separate consecutive blocks within a message, in particular with error correction.

ACK as a control character for a positive confirmation instead of using combination 6/0

Sync β as a second character for synchronous systems, considering that CCITT requires two such characters.

Furthermore we agree with the views expressed in document ISO/TC 97/SC 2(Italy-2)85 and support the proposal to replace LEM by PEM.

Representation of the Codes in Media

The 6 and 7 bit codes cannot be finally accepted unless an agreement has been established for representing the codes in the most important media, such as punched tape and magnetic tape. For both these media we recommend to represent the 6 bit code by placing bits 1 to 6 in the tracks with same numbers and the Parity Bit in track 7. In punched tape the 7 bit code should be represented by placing bits 1 to 7 in the tracks with the same number and the Parity Bit in track 8.

Moreover, an agreement should be attempted for the representation of the codes in punched cards and for the bit sequence in data transmission.

March, 1964

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

Technical Committee 97 -- Computers and Information Processing

Sub-Committee 2 -- Character Sets and Coding

POLISH PROPOSAL OF INSERTION OF ACCENTUATED
LETTERS IN THE 5 BIT CHARACTER CODE PROPOSED
BY ISO

STATEMENT OF THE PROBLEM

Only three characters "Reserved for National Use" are foreseen in the ISO 6 bit code proposition /Doc. ISO/TC 97/SC 2 /Secr.-22/ 75/. This number is not always sufficient. For instance, the Polish alphabet comprises more than three various accented letters.

Moreover, the proposed insertion of national letters at the end of the alphabet is often discordant with their natural collating sequence.

The Polish proposal aims to eliminate these inconveniences by introducing some minimal changes to the present ISO proposition.

PROPOSED SOLUTION

According to fig. 1 we propose:

For diacritics:

acute accent ' as graphical alternative to <

grave accent ` as graphical alternative to >

diaeresis " as graphical alternative to =

underline _ or cedilla ¸ as character 2/0

circumflex ^ or tilde ~ as character 3/11.

Currency Sign CS as character 3/12

Back Space BS as character 3/13

Accentuated letters we propose to express as three characters

Letter, Back Space, Diacritic.

NOTES

/1/ As diacritics ' ` " are only graphical alternatives to characters < > = we can, for instance, read

A ' B as A < B

A ` B as A > B

A " B as A = B

This representation gives only a slight inconvenience in reading mathematical relations.

/2/ Character 3/11 may be considered as general "upper diacritic".

For instance, if it is represented by circumflex, it is possible to write

Polish ȳ as ŷ

Icelandic æ as â

etc.

Character 2/0 may be considered as general "lower diacritic". For instance, if it is represented by "underline", it is possible to write

Polish ą as a

French ç as c

etc.

Such uncorrectness of some accentuated letter representation can often be tolerated.

/3/ Some other graphics can be used as diacritics. For instance we can write

Polish Ł as L, Back Space, -

Norwegian ø as O, Back Space, /

/4/ Including BS in position following all other letters we obtain natural collating sequence for accentuated letters. For instance:

Polish Ł, expressed as

L, Back Space, -

follows the combination

L, any letter

but is before the combination

M, any letter

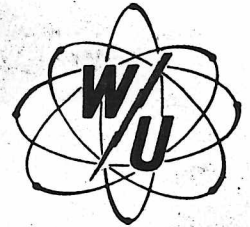
/5/ Character Null, eliminated in our proposal, may be possibly substituted by any control character not being used or by the character "Delete".

		C	1	2	3
		00	01	10	11
0	0000	Space	0	_ or .	E
1	0001	HT	1	A	Q
2	0010	LF	2	B	R
3	0011	VT	3	C	S
4	0100	FF	4	D	T
5	0101	CR	5	E	U
6	0110	SO	6	F	V
7	0111	SI	7	G	W
8	1000	(	8	H	X
9	1001	)	9	I	Y
10	1010	*	:	J	Z
11	1011	+	;	K	_ or .
12	1100	, comma	< or "	L	CS
13	1101	-	= or "	M	ES
14	1110	°	> or "	N	Escape
15	1111	/	'apostroph.	O	Delete

Western Union Technical Review

Volume 15

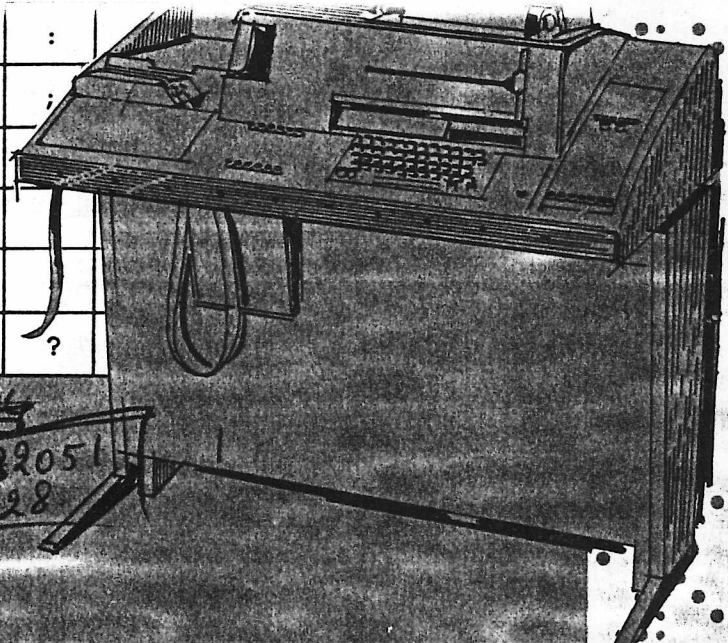
Number 2



APRIL 1964

ASCII	000	001	010	011	100	101	110	111
0000	NULL	DC ₀	⌘	0	@	P		
0001	SOM	DC ₁	!	1	A	Q		
0010	EOA	DC ₂	"	2	B	R		
0011	EOM	DC ₃	#	3	C	S		
0100	EOT	DC ₄ (STOP)	\$	4	D	T		
0101	WRU	ERR	%	5	E	U		
0110	RU	SYNC	&	6	F	V		
0111	BELL	LEM	'	7	G	W		
1000	FE ₀	S ₀	(	8	H	X		
1001	HT	S ₁	)	9	I	Y		

1010	LF	S ₂	*	:
1011	V TAB	S ₃	+	;
1100	FF	S ₄	,	
1101	CR	S ₅	-	
1110	SO	S ₆	.	
1111	SI	S ₇	/	?



NEW
ASCII CODE

621.382051
W528

S 1 2 3 4 5 6 7 C R S 1 2 3 4 5 6 7 C R

621.382051

NEW

AMERICAN STANDARD CODE

for

INFORMATION INTERCHANGE

Introduction

On June 17, 1963 the American Standards Association (ASA) approved a new American Standard Code for Information Interchange.* The new code, commonly referred to as ASCII (usually pronounced *asky*), was developed after four years of work by a committee of experts in information processing and communications, at an estimated cost of more than three million dollars. ASCII is a 7-bit code intended for information interchange among data processing systems, communications systems, and associated equipments. Since it was developed to meet both message communications and data processing requirements, it represents a compromise between the needs of communicators and data processors, not ideal for either group but acceptable to both.

The use of centralized computers, connected to data originating points via communications facilities, is increasing rapidly, and the new code is expected to find wide application in future systems. In fact, the first two large-scale uses of the new code in Western Union will be in the AUTODIN overseas system, now being developed by Western Union for the Department of Defense, and the nationwide Advanced Record System now being built by Western Union for the General Services Administration. This article, therefore, is intended to explain the logic designed into the new code to telegraph-oriented engineers and other technical personnel.

* Copies of the "American Standard Code for Information Interchange—X3.4-1963" can be obtained from the American Standards Association, Inc., 10 E. 40th St., New York 16, N. Y. at \$1.30 per copy.

Before developing the new code, ASA subcommittee X3.2 reviewed more than sixty existing codes, including the Baudot code, but decided that none of these were suitable for use as a standard for general information interchange.

History of the Baudot Code

The so-called Baudot code, used almost universally in printing telegraph systems today, is named for Jean Maurice Emile Baudot (1845-1903), an officer in the French Telegraph Service. However, Baudot did not invent the 5-level code, which had been used for cryptography by Sir Francis Bacon as far back as 1605. Neither did Baudot develop the code assignments for the letters, symbols and functions in use today. Nevertheless, it is fitting that the 5-level code be named for Baudot because of his many significant contributions to the telegraph art. Even today it is difficult to design telegraph apparatus without using one or more of the principles first conceived by Baudot.

Between 1899 and 1901, Donald Murray, an Australian newspaperman, developed and patented a high-speed one-channel printing telegraph. Murray developed his own code assignments for the 32 permutations possible with a 5-level code. He assigned the permutations containing the least number of marking pulses to the most frequently used characters, in order to keep the number of holes punched in perforated tape to a minimum. One apparent discrepancy in his code was the assignment of two marking pulses to the letter "Z," which is the least frequently used letter in the English

alphabet. This may have been a concession to some European languages, in which "Z" occurs frequently.

Western Union purchased the American rights to Murray's patents and adopted his code assignments for the letters of the alphabet and the 10 digits. However, Western Union did change some of his code assignments for upper case characters. Murray's code differed from the Baudot code, then used in Europe, for every character except the letter "I." Telegraph engineers recognized the advantages of Murray's code in minimizing wear on perforating mechanisms, tape transmitters, and relays. Eventually it was adopted by Europeans and, again with changes in some upper case character assignments, became the standard CCITT (International Telegraph and Telephone Consultative Committee) No. 2 code.

The Baudot code has been used in telegraphy since 1874 and will undoubtedly continue to be used for transmission of the bulk of administrative messages for many years to come. However, it does have certain built-in disadvantages which make it unsuitable for general use in data communications systems. Although there are 32 possible permutations of the 5-level code, one of these (blank or all

spacing) is not normally used and five other permutations are reserved for machine functions such as carriage return and line feed. This limits the number of possible graphics (printed characters) to 26 lower case and 26 upper case characters. Some data processing systems require more than these 52 graphics. In addition, it is necessary to use figures and letters shift to obtain the dual meaning for 26 characters. In data processing systems, there are disadvantages in using an ambiguous code in which the meaning of a frequently used character can depend upon a previous character. Also, the Baudot code is not structured so that collating and sequencing operations can be accomplished by simple binary arithmetic operations in data processing systems. (For readers not familiar with binary arithmetic, an explanation of the fundamentals is given in Appendix A).

Choice of a 7-Bit Code

ASA Subcommittee X3.2, which developed the new code, attempted to develop a 6-bit standard code, because many existing computers use a 6-bit code in their internal operations. (Note: In computer terminology, the word "bit" is a contraction of "binary digit" and is used in the remainder of this article instead of the word "unit" or "level," commonly used in telegraph terminology. Likewise, the terms "0" and "1" are used instead of "spacing" and "marking" pulses, respectively.) A 6-bit code would perhaps have been adequate for either data processing or message communications, but it was not possible to include all the alphabets, numerics, special symbols, and control characters required for general information interchange within a 6-bit code. An 8-bit code was also considered, since this would permit transmitting two 4-bit binary-coded decimals (See Glossary) per 8-bits. However, it was decided that an 8-bit code would be too wasteful for most users, because 256 characters are seldom required even in data processing. Finally, 7 bits were chosen as the minimum number which would permit derivation of all the required characters. Thus, this code provides 128 possible characters, each

or permutation.

Structure of the Code

In discussing the ASCII code, it is convenient to arrange the 128 bit permutations in 8 vertical columns, with 16 horizontal rows in each column, as shown in Table 1. The vertical columns are identified by the three high-order bits (7, 6 and 5, or b_7 , b_6 and b_5) and the 16 horizontal rows by the four low-order bits (b_4 , b_3 , b_2 and b_1). The table is arranged in continuous increasing binary sequence, from top to bottom in the horizontal rows and from left to right in the vertical columns. The binary number "0000000" (decimal zero) thus appears in the top row in the left-hand column and the binary number "1111111" (decimal 127) appears in the bottom row in the right hand column. The bit pattern for any

TABLE I

b ₇	→	0	0	0	0	1	1	1	1	
b ₆	→	0	0	1	1	0	0	1	1	
b ₅	→	0	1	0	1	0	1	0	1	
b ₄	↓									
b ₃	↓									
b ₂	↓									
b ₁	↓									
0 0 0 0		NULL	DC ₀	␣	0	@	P			
0 0 0 1		SOM	DC ₁	!	1	A	Q			
0 0 1 0		EOA	DC ₂	"	2	B	R			
0 0 1 1		EOM	DC ₃	#	3	C	S			
0 1 0 0		EOT	DC ₄ STOP	\$	4	D	T			
0 1 0 1		WRU	ERR	%	5	E	U			
0 1 1 0		RU	SYNC	&	6	F	V			
0 1 1 1		BELL	LEM (APOS)	'	7	G	W			
1 0 0 0		FE ₀	S ₀	(	8	H	X			
1 0 0 1		HT SK	S ₁	)	9	I	Y			
1 0 1 0		LF	S ₂	*	:	J	Z			
1 0 1 1		VTAB	S ₃	+	;	K	[			
1 1 0 0		FF	S ₄	,	<	L	\			
1 1 0 1		CR	S ₅	COMMA	=	M	]			
1 1 1 0		SO	S ₆	HYPHEN	>	N	^			
1 1 1 1		SI	S ₇	/	?	0	←			
										DEL

NULL—Null/Idle
 SOM—Start of Message
 EOA—End of Address
 DC₀—Device Control
 DC₁—Device Control
 DC₂—Device Control
 DC₃—Device Control
 DC₄ (STOP)—Device Control (Stop)
 ERR—Error
 EOM—End of Message
 EOT—End of Transmission
 WRU—"Who are you?"
 RU—"Are you . . .?"
 BELL—Audible Signal
 FE₀—Format Effector
 HT—Horizontal Tabulation
 SK—Skip (punched card)
 LF—Line Feed
 VTAB—Vertical Tabulation

FF—Form Feed
 CR—Carriage Return
 SO—Shift Out
 SI—Shift In
 DC₀—Device control reserved for Data Link Escape
 SYNC—Synchronous Idle
 LEM—Logical End of Media
 S₀—S₇—Separator (information)
 ␣—Space (Word separator, normally non-printing)
 <—Less Than
 >—Greater Than
 ^—Up Arrow (Exponentiation)
 ←—Left Arrow (Implies/Replaced by)
 \—Reverse Slant
 ACK—Acknowledge
 ①—Unassigned Control
 ESC—Escape
 DEL—Delete/Idle

character is usually given in the high-order to low-order bit sequence. Thus, the bit pattern, or "code," for the letter R is:

Bit number:	7	6	5	4	3	2	1
Bit pattern:	1	0	1	0	0	1	0

This order may appear to be the reverse of that normally used in telegraph communications, where bits are usually given in the low-order to high-order bit sequence. But binary numbers, like decimal numbers, are given high-order digit first.

In developing the code, the ASA Subcommittee decided to place the 64 graphics in a "dense graphic subset"; that is, in a block of 64 consecutive binary numbers, preferably in four contiguous columns. First choice for the placement of this subset was either the first four or the last four vertical columns, since this would have permitted identifying the graphic subset with relatively simple circuitry by examining bit 7. However, the graphics could not be placed in the first four columns because the "all-zeros" character was reserved for the "null," or idle, character. This permits continuing the traditional use of blank perforated tape as a leader at the beginning of a message. It was also decided to reserve the "all-ones" bit pattern for the "delete" character in order to permit its traditional use as a

mation in a desired sequence. For example, conventional usage requires that the name "Johns" appear ahead of "Johnson" in an alphabetical listing. This requirement resulted in the word separator (space) being assigned to the lowest binary number in the graphic subset. Similarly, a name such as "West, W." should collate ahead of "Weston." This convention resulted in the comma being placed ahead of (or assigned to a lower binary number than) all letters and digits. Other commonly used punctuation marks were also placed in the first of the four graphic columns.

In order to permit a 4-bit numeric subset to be derived from the code, the ten digits were placed so that the four low-order bits represent the binary coded equivalents of their decimal values. The standard implies that the preferred characters to be included with the 10 digits in such a 4-bit subset are the asterisk, plus, comma, hyphen, period and slant. Since these six characters are not located in the same column as the digits, the 4-bit subset cannot be directly derived by merely dropping the three high-order bits. This will present no problem in contracting to a 4-bit subset, but will complicate the expansion of the 4-bit subset to a 6-bit or

middle columns were finally chosen as the best compromise. In each of these columns, bit 6 is different from bit 7. This will permit identification of the graphic subset with relatively simple circuitry by a comparison of bits 6 and 7.

Most of the control characters were placed in the first two columns, and each class of controls was arranged in hierarchical order. At present, all of the characters in the seventh column and most of the characters in the last column are unassigned.

Structure of the Graphic Subset

The arrangement of the characters in the graphic subset was strongly influenced by considerations of the ordering, collating, and sequencing operations in data processing systems. The graphics are arranged so that a simple comparison of binary codes can be used to order infor-

The colon and semi-colon, which are less frequently used than the other punctuation marks, were placed immediately after the ten digits because of international considerations. In areas where the pound sterling monetary system, with its 12 pennies in a shilling, is used, these two characters can be replaced by the "digits" 10 and 11.

Design of typewriter-like devices such as teleprinters was also considered in developing the standard. An effort was made to place characters which are normally paired on a typewriter keypad so that they differed by only one bit. This will simplify the design of keyboards using the new code by permitting a shift key to be used to invert one bit. However, not all of the traditional keypad pairings were retained, since other considerations conflicted with this requirement. For example, the digits 2, 3, 4 and 5 differ from

the characters normally associated with them on a typewriter keyboard only in bit 5. The other digits are not as simply related to their corresponding "upper case" assignments.

The 26 letters of the alphabet were assigned to a continuous block of binary numbers in the 3rd and 4th columns of the graphic subset, and arranged in increasing binary sequence from A through Z. Five infrequently used symbols were placed in the fourth column immediately following the alphabet. These symbols can be dropped in order to accommodate foreign alphabets containing more than 26 letters.

A 6-bit graphic subset can be derived from the standard by dropping bit 6. The resulting subset will still retain the collating order used in the standard. In order to use such a code for communications purposes, it would be necessary to substitute carriage return and line feed for the asterisk and hyphen, or for two other infrequently used characters.

Control Characters

The controls included in the code fall into four classes: (1) transmission controls; (2) format effectors; (3) device controls; and (4) information separators. These four classes are grouped together and located in the first two columns of the table in the order given. Each class of controls is arranged in hierarchical order, but there is not intended to be a hierarchical relationship between classes. The first 8 characters, such as "start of message" and "end of transmission," are classed as "transmission controls," since they are used primarily in communications. The second group, format effectors, contains characters which are used to organize printed data on a page, such as carriage return, line feed, and vertical tabulation. The third group consists of device controls, useful in controlling the operation of auxiliary equipment. Use of these controls has not yet been standardized, but it is anticipated that they will be used for such purposes as turning an auxiliary reperforator on or off and starting or stopping a tape transmitter. The last group consists of information

separators, used to identify boundaries of various elements of information. These controls, also called data delimiters, are machine-oriented controls used in data processing to serve a purpose similar to that of punctuation marks in message communications. Their exact usage has not yet been defined.

Several special controls which do not logically fall into one of the four classes previously described are also included in the code. The "shift out" character signifies that the graphic characters which follow have alternate meanings; that is, meanings other than those shown in the ASA code table. The "shift in" character denotes a return to the standard graphic subset. Use of these two characters is thus somewhat analogous to the figures and letters shift characters in the Baudot code.

The first character in the device control group (DC₀) has been reserved for "Data link escape." Use of this control has not been formalized as yet, but it is expected to serve a purpose similar to the "shift out" character. The latter character is intended primarily for communications use while the "Data link escape" is intended to provide supplementary con-

The "escape" character also signifies an "escape" from the ASCII code. Exact use of this character has not been formalized either, but it is intended to modify the meaning of the following character or characters. This control is intended to provide a broad expansion of the code for special uses. For example, it could be used for communicating in those foreign languages which do not use the Roman alphabet.

The three remaining controls are the "error," "synchronous idle," and "logical end of media" characters. The "error" is for use in indicating an error in data. The "sync" is for use in achieving or retaining synchronism in synchronous transmission systems. The "logical end of media" is intended for use as an end-of-tape or end-of-card, etc. character. It does not necessarily occur at the physical end of the medium. For example, in perforated tape, it could be followed by blank

tape.

The "acknowledge" character is intended for use as a single-character answer-back. Its position in the table was chosen to permit generation of the character by relatively simple means; that is, by generating an open line for 3 bit-lengths in a start-stop system. This choice was probably influenced by the use of automatically generated "V" answer-backs in many telegraph communications systems.

Some Shortcomings of the ASCII

The new ASCII code is a significant achievement in the field of standardization and its adoption as a standard may well mark the beginning of a new era of standardization in the communications and data processing fields. For the first time, a committee of experts representing many fields and many competitive companies worked together to develop from "scratch" a standard code; that is, the new code, unlike the CCITT No. 2 code, is not based on any code previously in use. This permitted the committee to base the code primarily on logical considerations, with historical convention being considered only where such considerations might influence future implementation of the code. In spite of this, however, the code does have some shortcomings.

For communications use, the new code has numerous disadvantages. Use of a 7-bit code for message communications is wasteful of transmission time, since a 5-bit code is adequate for most message communications. In addition, a 7-bit code results in a higher modulation rate for a given speed than does a 5-bit code. In some cases, this will require more expensive transmission facilities for use with the new code. For example, use of the new code with a unit-length start pulse, a parity check pulse, and a two-unit stop (or rest) pulse (11-unit code pattern) will result in a modulation rate of 110 bauds at a transmission speed of 100 words per minute. Thus, use of the new code at 100 words per minute over Western Union facilities will require use of Type 70 carrier terminals.

There is no error protection included in

the 7-bit code. However, it seems probable that most communications systems which use the new code will use an 8-bit code, with the added bit used to provide an even vertical parity check. (This may eventually be adopted as part of the standard.) An even parity must be used in paper tape in order to preserve the validity of the "rub-out" and "blank" characters. In magnetic tape, other considerations dictate the use of odd parity. This discrepancy may someday prove to be a disadvantage.

Other error considerations were not entirely ignored in developing the new code. Most of the control characters were placed in the first two columns of the code in order to reduce the likelihood of generating a control code during idle transmission time by "hits," or short opens, on the line.

A conventional 3-row teleprinter keyboard cannot be designed to generate the ASCII code, because of the large number of characters used in the code. There is no simple relationship between the digits and the letters of the alphabet with which they are normally paired on a teleprinter keyboard. For example, the code for the letter E is 1000101; the code for the digit 3, which is paired with E on teleprinter keyboards, is 0110011. A keyboard designed for use with the new code must

therefore be more like a typewriter, or a standard expanded 4-row teleprinter, keyboard. Figure 1 shows the keyboard layout for the Teletype Model 35 teleprinter, designed to utilize the new code. To use this keyboard, a teleprinter operator must learn a new touch-typing system for all of the digits and punctuation marks.

From a communications standpoint, there are two other minor shortcomings in the ASCII code. First, the 7-bit code will be difficult for maintenance and supervisory personnel to memorize. Secondly, data processing considerations prevented assigning the permutations containing the least number of "ones" to the most frequently used characters. This will result in increased wear, and thus higher maintenance costs, on reperforators, transmitters, and relays.

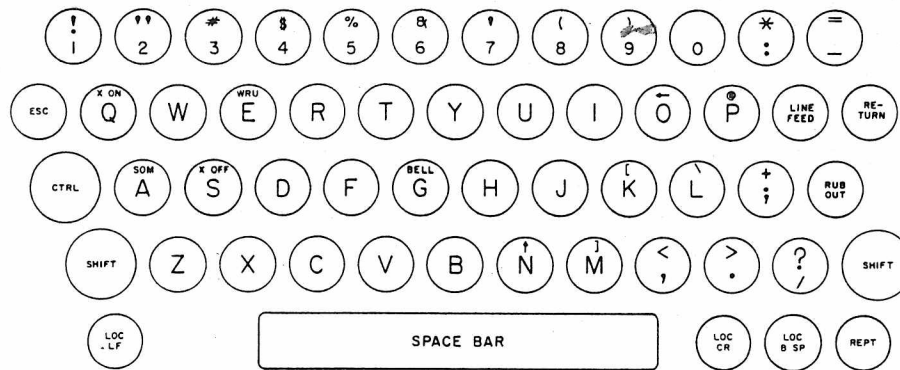


Figure 1. Model 35 Teleprinter and ASR Set Keyboard Layout

The Future of ASCII

The Teletype Corporation has already designed, and is now manufacturing, two lines of equipment which use the new ASCII code. Teletype's Model 33 teleprinters and ASR sets are basically the same as the light-duty Model 32 units, but designed for the new 7-bit code. The Model 35 teleprinters and ASR sets are basically heavy-duty Model 28 units redesigned for use with the new code. All of these units actually generate an 8-bit code, with an 11-unit code pattern. At present, there are two different types of keyboards available. In one type, bit 8

or stop, pulse is thus three units long. In the other type, bit 8 is used as a vertical parity-check bit (even parity).

A Teletype spokesman has been quoted in the public press (Business Week, June 15, 1963) as saying that Teletype expects half of their customers to be using the new code within five years. While this prediction may prove to be overly optimistic concerning the future of the 8-bit equipment, there appears to be little doubt that the new code will come into widespread use for data interchange in the years ahead. It appears doubtful that Western Union will ever adopt the new code for use in its public message service. Besides being wasteful of transmission time for message communications, its use would require extensive operator retraining. Also, it appears unlikely that existing private wire systems used primarily for message communications will be converted to the new code. Such an expensive

conversion can only be justified where a private wire system is used primarily for data interchange.

The future of the ASCII code is enhanced by the revolution in data processing now in progress. As more and more companies and government agencies automate and centralize their data processing, the new code will almost certainly come into widespread use. New communications systems will be designed and built for use with the new code and perhaps some existing systems will be replaced by newer ones designed primarily for data interchange. A number of manufacturers of computers and data processing equip-

ment are already providing "hardware" for use with the new code. Use of the new code will, for the first time, make possible the interchange of information between equipments made by different manufacturers.

Much standardization work remains to be done on the code itself and on implementation of the code. This work is proceeding at a rapid pace. By the time this article appears in print, it is possible that the code will have been modified to include a lower case alphabet in the unassigned area. Inclusion of the lower case alphabet will probably be followed by adoption of the code as an international standard by the International Standards Organization.

A standard for one-inch perforated paper tape will be issued in the near future. Work is continuing on standards for magnetic tape and punched cards using the new code.

GLOSSARY

- Acknowledge** A character generated at a receiving device to indicate to the sending device that information has been received successfully.
- Are you?** A request for a station to indicate if it is the station whose identification immediately follows the "RU" character.
- Binary** Consisting of two.
- Binary-coded decimal** A representation of a decimal digit by means of a binary code.
- Binary digit** Either zero or one, the only two digits used in binary counting.
- Bit** A contraction of "binary digit."
- Bit pattern** Any discrete permutation of the seven bits of the ASCII code.
- Character** The meaning, or interpretation, assigned to any discrete bit pattern.
- Collate** To examine and compare; to place in order.
- Collating sequence** The sequence in which the characters acceptable to a computer are ordered.
- Combinations** Arrangement of things into groups so that each group has which they are arranged.
- Data link escape** A conditioning character which will change the meaning of one or more following bit patterns. It is intended to provide supplementary control in data transmission links.
- Device Control** A functional character used to control an ancillary device or devices, more specifically intended for switching devices "on" or "off."
- End-of-address** The character used to separate the machine-sensible address or routing part of a message from the following parts of the message.
- End-of-message** The last character of a message, except that in systems employing error control, there is a possibility the error control character or characters may follow the EOM character.
- End-of-transmission** The character used to denote the end of a transmission. A transmission may include more than one message.
- Error** The character used to indicate that there has been an error in the information with which it is associated.
- Escape** A conditioning character used to change the meaning of one or more of the following characters. It is intended to provide supplementary characters in general information interchange.

- Format effector** A functional character which controls the layout or position of information in input/output media.
- Graphic** A written or printed letter or symbol.
- Hierarchical** Classified in order of higher and lower rank.
- Information separator** ... A character used to separate information in a logical sense. These characters are intended to be used in a hierarchical order.
- Logical end of medium** ... A functional character which identifies the end of information on a unit of physical material such as punched card or tape. This character is not necessarily located at the physical end of the recording material.
- Order** The way in which things are arranged.
- Permutation** The order in which a set of things is arranged.
- Sequence** To arrange objects or items in a given order.
- Set** Any collection of objects or things.
- Shift-in** The shift-in character means that all the bit patterns which follow shall be interpreted according to the ASCII code table.
- The shift-out character means that the graphic bit patterns which follow may have alternate interpretations until a shift-in character is received.
- Start of message** The first character of a message. "Message" includes *all* information, such as header, text, and preamble.
- Subset** Any collection of objects or items contained within a larger set.
- Superset** A collection of objects or things which contains a smaller set within it.
- Synchronize** A character transmitted by a synchronous transmission system in the absence of any other character to provide a signal from which synchronism may be achieved or retained.
- Transmission control** A functional character intended to control or facilitate transmission of information over telecommunication networks.
- Who are you?** A request for a station to identify itself.

Appendix D-4

Report of Meeting No. 11, ASA Task Group X3.2.4
Code Assignments
April 14 and 15, 1964
BEMA Headquarters, New York City

1. Attendance

Members and Attendees	Affiliation	Status	April	
			14	15
H. Spielman, Chairman	RCA	M	X	X
J. B. Ancona (Proxy for Davis)	IBM	P	X	
O. R. Arne	Mergenthaler Linotype	M	X	X
J. F. Auwaerter	Teletype Corp.	M		
E. A. Avakian	Teleregister	M	X	X
J. B. Booth	Teletype Corp.	A	X	X
E. H. Clamons	Univac	A		
C. J. Davis	IBM	M		
J. G. Doyle	Fairchild Graphic	M		
W. F. Emmons	IBM	A		X
R. F. Ewald	BTL	A		
E. S. Ferguson	Rockford Research Instl.	O	X	X
J. G. Griffis	DCA	M	X	X
R. M. Gryb	AT&T	M		
L. B. Haigh	ITT Comm. Systems	O		X
G. V. Hawkins	IBM	O	X	
W. F. Huf	Navy	M	X	X
J. D. Keen	Univac Div.	M		
D. A. Kerr	Bell Telephone Labs.	A	X	X
W. Y. Lang	BTL	M	X	X
E. J. Lewis	ITT - DISD	M	X	X
J. L. Little	National Bureau of Standards	M	X	X
C. E. Mackenzie	IBM	O		X
E. F. Manning	USAE LRDL	M		X
J. K. Nelson	Western Union	M		
F. W. Smith	Western Union	A		
R. R. Spalholz	Fairchild Graphic	A		
L. A. Tate	IBM	O	X	
H. Tholstrup	Friden	M		
L. R. Turner	NASA	M	X	X
H. C. Umstead	USAE LRDL	A		
E. F. Vidro, Jr.	Xerox Corp.	M	X	X
A. L. Whitman	ITT Communications Systems	M		X

M = Member
A = Alternate
O = Observer
P = Proxy

- 2 -

2. Documents Assigned X3.2.4 Numbers

X3.2.4/

- 21 Letter to L. L. Griffin from W. Y. Lang
X3.2/94, March 23, 1964.
- 22 Memo from L. R. Turner on WRU, RU and INQ,
March 30, 1964.
- 23 Memo for Chairman X3.2.4 from L. L. Griffin,
Message Parts in DOD, 2 April 1964.
- 24 ISO/TC97/SC2 (Italy -2)85E, Working Paper on
Changing LEM to PEM, January 1964.
- 25 Memo from E. A. Avakian on Various Controls,
April 13, 1964.
- 26 Letter to Chairman of X3.2 from A. H. Stillman,
Chairman of X3.3, Action on Various Items,
April 8, 1964.
- 27 "Some Notes on Code-Insensitivity in Digital
Switching" by L. B. Haigh, ITT Comm. Systems,
14 April 1964.
- 28 ITT Inter-Office Memo on Parity and Subcommittee
X3.3, by L. B. Haigh, 9 April, 1964.
- 29 Draft of U.S. Position on "LEM" as opposed to
"PEM" by D. A. Kerr, April 14, 1964.
- 30 Explanatory Remarks on Proposed Modification of the
ISO 7-Bit Code Table, April 16, 1964.

3. The status of D. A. Kerr was changed from observer to alternate member.
E. S. Ferguson of Rockford Research Institute applied for an observership.
It was noted that Fairchild Graphic Systems has not been participating.
4. Document 24 from Italy was reviewed. That document favors PEM (Physical
End of Medium) over LEM (Logical End of Medium). D. A. Kerr prepared
Document 29 as a draft of a rebuttal to be forwarded to X3.2, with a
suggestion that L. L. Griffin be asked to revise the U.S. Position Docu-
ment X3.2/45 on LEM.

5. The matter of RU (Are You) and CNCL (Cancel) was discussed. Mr. Avakian moved that Cancel be discussed first and then RU. This passed by a vote of 9 to 0, with 2 abstentions.
6. It was noted that Cancel is needed as a single-character control, because in many transmissions it is not possible to stretch time in order to replace one character with a two-character sequence. Likewise, in media, space is not always available for a two-character replacement of one faulty character.

7. Two uses for CNCL were delineated:

- a. Denotes error in "this block" and/or
- b. Replaces a faulty character.

It was suggested that more time is needed to study the implications involved in selecting one or both of these uses.

8. It was decided that a revised code table and expository remarks should be transmitted to X3.2 showing both RU and CNCL in Column 0, Row 6, and that a note state that this is not a dual assignment but that a choice for one or the other is to be made. The definitions of RU and CNCL are to accompany the code table.
9. It was decided to retain the broad (dual) definition of Cancel at this time, rather than exclude one of the proposed uses.
10. It was moved by Mr. Ancona that CNCL be defined as follows:

"A character used to replace an erroneous character, or to mark a string of characters within which an error has been detected."

The vote was 6 for, 5 against, 1 abstaining.

11. L. L. Griffin pointed out that the X3.2.4 assignments of the pairs ACK-EOB and SS-ES could be interchanged. This would give ACK and NACK an opposite parity and retain a difference in four bits between ACK and NACK, including parity where it is used. It would also place SS and ES adjacent to the other information separators. The characters in Column 1, Rows 8 through 15 would then be ACK, EOB, SS, ES, FS, GS, RS and US. Mr. Long moved to accept this and it carried 8 to zero, with 3 abstentions.
12. Mr. Griffin's memo, Document 23, was discussed with respect to the proposed names of communication controls. After considerable discussion, Mr. Huff moved to substitute SOH (Start of Heading) for the X3.2.4 proposed SOA (Start of Address) or ASCII SOM (Start of Message) in Column 0, Row 1. This carried by a vote of 8 to 2, with 2 abstentions. The changes proposed in Document 23 were not accepted.

13. It was decided to revise the X3.2.4 Expository Remarks of April 2, 1964 by removing non-essential details. (This resulted in Document 30, dated April 16, 1964 which was also designated X3.2/111, and further revised by X3.2 to become Document X3.2/112).
14. Comments on the Letter Ballot for the ISO Second Draft Proposal on 6- and 7- Bit Codes (ISO/TC97/SC2/SECR-22)75 from Italy, Poland, Switzerland, United Kingdom and Germany were reviewed. Comments from France were not yet available. These comments have been designated as X3.2/106. No action was generated. Allen Whitman suggested that the comments from C.C.I.T.T. in X3.2/110 should also be reviewed.
15. The remainder of the meeting was utilized in revising the Draft Explanatory Remarks into the form presented as Document 30.

John L. Little
John L. Little
Secretary, X3.2.4

cc: Members of X3.2.4

bema

Data Processing Group

Business Equipment Manufacturers Association
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SUBCOMMITTEE X3.2-CHARACTER SETS AND DATA FORMAT

X3.2/122
May 15, 1964

UNDER ASA SECTIONAL COMMITTEE X3-COMPUTERS AND INFORMATION PROCESSING

MINUTES

Meeting #37, 16-17 April, 1964
BEMA, New York City

SUMMARY

1. Approved:

- a. Document X3.2/98 April 15, 1964 titled "Delegate Instructions for ISO/TC97/SC2 Working Group A meeting May 11-14, New York City."
- b. Document X3.2/112 April 17, 1964 titled "Explanatory Remarks on Proposed Modifications of the ISO 7 Bit Control Functions".
- c. Document X3.2/109 April 16, 1964 titled "Suggested Program of Work (with priority) for ISO/TC97/SC2, SC4 and JWG on Punched Cards."
- d. The following motion by roll call vote:

"The U. S. Delegation to SC2 be instructed to work for advancing the Second Draft ISO Proposal 6 and 7 bit codes to Recommendation stage with such modifications as may be practical and consistent with the above to work for the modifications stated in X3.2/112.

- e. Document X3.2/101 as the approach to development of a standard collating sequence.

2. Reported on:

- a. The expository remarks for the Proposed. American Standard Recorded Magnetic Tape.
- b. The explanatory remarks for the Proposed American Standard Take Up Reel for One Inch Perforated Tape.
- c. A position on NULL.
- d. Response to Rounded Corner Cut Negative Ballots.

PRIVATE ASA X3 COMMITTEE DOCUMENT

NOT FOR PUBLICATION

Respectfully submitted,

Theodore R. Bousquet
Theodore R. Bousquet
Secretary pro tem
X3.2 Meeting #37

X3.2/122
May 15, 1964

MINUTES OF MEETING #37-SUBCOMMITTEE X3.2

April 16 + 17, 1964

Presiding Officer: Mr. L. L. Griffin, Chairman Subcommittee X3.2

9 a.m. - 5:40 p.m. - 4/16/64 with recess for lunch

9 a.m. - 4:45 p.m. - 4/17/64 with recess for lunch

Place: BEMA Headquarters
235 E. 42 Street
New York 17, New York

Agenda Item #1 Attendance (See Appendix A)

Agenda Item #2 Minutes of previous meeting

The following changes were made to the minutes of meeting #36:

1. Summary page - corrected date to read "March 12 & 13, 1964"
2. Page 2, paragraph 3.2 - deleted "and was nominated to become an alternate member"
3. Page 4, paragraph 7 (b) - to read "R. Dilling (Chief delegate),"
4. Page 4, paragraph 7 (c) - to read "C. E. Mackenzie (Chief delegate),"
5. Page 6, paragraph 10 - corrected spelling to "Schneider"
6. Page 7, paragraph 10 - to read "D. B. Schneider (Chief delegate),"
7. Page 9, paragraph 15. The words "the following letter" should read "a letter."
8. Page 9, paragraph 15. The NOTE that reads "in the minutes of X3.2.4" should read "in Appendix E."
9. Appendix D-3, page 5, paragraph 15 move "osterman" from "For" column to "Against" column. Change vote tally to "For-2", "Against-7."
10. Appendix D-3, paragraphs 18-20 are renumbered 19-21 and the following paragraph is inserted as 18.
18. Complete code chart of X3.2.3/10 be accepted by X3.2.3

The motion was seconded by Mr. Locke, and failed to pass by the following vote.

PRIVATE ASA X3 COMMITTEE DOCUMENT

NOT FOR PUBLICATION

FOR-4

Yanne
Osterman
Brown
Locke

AGAINST-5

Griffin
Whitaker
Tobin
Umstead
Mullendore

ABSTAIN-1

Evans

Agenda Item #3 - Membership

1. Mr. James Taunt, General Electric, P0207 Phoenix Arizona, 85013, was approved as a principal member of X3.2.
2. Mr. Carl Schultheiss was given a proxy for Mr. C. E. Macon.
3. Mr. John Booth was given a proxy for Mr. E. A. Avakian.
4. Mr. L. L. Griffin reported he had sent letters to the Director of Project MAC and to E. S. Ferguson, Rockford Research Inst. inviting them to participate in Task Group X3.2.4 as Official Observers.

Agenda Item #4 - Meeting Agenda

1. The draft agenda proposed by the chairman and amended by the subcommittee was adopted and is attached as Appendix B.
2. It was suggested that the Chairman of X3.2 rotate the order of Action Items in preparation of future agenda.

Agenda Item #4.1 - Scheduling of X3.2 and T. G. Meetings

1. Mr. MacKenzie moved that:

Future X3.2 and T. G. meetings starting with the June meeting be 3 days only.

Motion failed: Y (4) N (12) A (2)

2. Mr. Taunt moved that:

X3.2 and the Tasks Groups go back to a normal 3 day work schedule, Tuesday-Thursday, starting with the June meeting.

Motion passed: Y (14) N (1) A (3)

3. Normal schedule:

<u>Tuesday</u>	<u>Wednesday</u>	<u>Thursday</u>
	X3.2.1	
X3.2.5	X3.2.2	X3.2
X3.2.3	X3.2.4	
X3.2.4 (June only)	X3.2.6	

Agenda Item #6 - Numerical Control of Machine Tools

1. Mr. Auwaerter moved that:

X3.2 accept document X3.2/98 April 15, 1964 titled "Delegate Instructions for ISO/TC97/SC2 Working Group A meeting May 11-14, New York City."

Motion passed: Y (17) N (0) A (3)

2. Mr. Auwaerter moved that:

The chairman appoint a member from X3.2 to become a member of the delegation on Numeric Machine Tool Controls.

Motion passed: Y (19) N (0) A (1)

3. Mr. Griffin named Mr. J. B. Booth as X3.2's member to the Numerical Machine Tool Control delegation.

Agenda Item #7 - Report of X3.2

1. X3.2.1 Task Group Report - Mr. V. L. Thompson

- a. The expository remarks were reworked and will be ready for the June meeting of X3.2.
- b. X3.2.1 recommends that document X3.2/105 titled "X3.2.1 answer to General Services Administration Comment Request No. 5835-4-004-2" be approved.
- c. R. Courtney was selected to represent X3.2.1 on X3.2.6.

2. X3.2.2 Task Group Report - Mr. J. F. Auwaerter

- a. The explanatory remarks for the Proposed American Standard Take-Up Reel for One Inch Perforated Tape were worked on and will be mailed out. Mr. Auwaerter urged that the members return their vote on the take up reel before May 1, 1964, if it was at all possible.

- b. No Action items were necessary for X3.2.2
- c. Mr. R. F. Ewald is X3.2.2 representative to X.2.3.6.
- 3. X3.2.3 Task Group Report - Mr. C. E. Mackenzie
 - a. X3.2.3 has three action items
 - 1. Instructions to the U. S. Delegation to ISO/TC97/SC2 and ISO/TC97/SC4.
 - 2. A Work Program for ISO/TC97/SC2 and ISO/TC97/SC4 - see document X3.2/103.
 - 3. X3.2.3 recommended the document X3.2/89 be forwarded to ISO/TC97/SC4.
 - b. Position on NULL

X3.2.3 informs X3.2 and X3.2.4 that to resolve the Word Separator/Null impasse, X3.2.3 is proceeding on the assumption that the Null character will cause a service printer to advance one printing position without printing (i.e., "Space") and likewise cause a line printer to leave one unprinted position (i.e. "Space") for each Null character.
 - c. Mr. C. E. Mackenzie will act as the X3.2.3 liaison representative to X3.2.6
 - d. Responses to Rounded Corner Cut Negative Ballots have been generated, but have not yet been approved by X3.2.3. Further action will be taken at the June meeting.
- 4. X3.2.4 Task Group Report - Mr. H. Spielman
 - a. X3.2.4 has three action items
 - (1) Mr. Spielman reported on the document X3.2/102-ISO/TC97/SC2 (Italy-2) 85E which proposes changing the code 0010111 from LEM (Logical End of Medium) to PEM (Physical End of Medium). Mr. Spielman requested that X3.2 approve the document X3.2/108 "U. S. Position on "LEM" as opposed to "PEM".
 - (2) The following table was listed

<u>Original Recommendation</u>	<u>New Recommendation</u>
SS	ACK
ES	EOB
ACK	SS
EOB	ES

- X3.2.4 recommend that X3.2 substitute the new in place of the old recommendation in the Proposed Control Character Code Table. Also requests that SOH (Start of Heading) be used in place of SOA (Start of Address).
- (3) X3.2.4 request that RU and CNCL (Cancel) be included in the same box in the Proposed Control Character Code Table. X3.2.4 would at some future date determine which one was appropriate. This was not a dual use control.
- b. The explanatory remarks on the Proposed modifications to the Control functions were distributed with the request they be reviewed and approved. Document number X3.2/111.
- c. Mr. A. L. Whitman is X3.2.4 liaison representative to X3.2.6.
- 5. X3.2.5 Task Group Report - Mr. W. H. MacKenzie
 - a. Mr. R. Armstrong is X3.2.5 liaison representative to X3.2.6
 - b. X3.2.5 request that X3.2 endorse the approach to development of a standard collating sequence for ASCII as described in document X3.2/101 April 16, 1964.
 - c. The definition given in X3.2/88 for the information separators S4 to S7 were not acceptable to X3.2.5. The reasons were listed in document X3.2/100 April 16, 1964.
 - d. X3.2.5 request that X3.2 review the programs of work that was tabled at the last X3.2 meeting.
- 6. X3.2.5 Task Group Report - Mr. C. E. Mackenzie reporting for A. L. Whitman
 - a. X3.2.6 expects the Task Group to develop their own definitions. X3.2.6 will set a style for writing the definitions.
 - b. X3.2.6 has no Action Items.

Agenda Item #9 Action on X3.2.3 Items

- 1. Mr. C. E. Mackenzie moved that:

The U. S. delegation to ISO/TC97/SC2 and ISO/TC97/SC4 be instructed as follows:

"The U. S. is actively considering but not limiting discussion to a punched card code based in principle on the representation reflected in Document X3.2/37 "A Candidate 12-Row Punched Card Code."

"The U. S. currently favors the representation shown in Document X3.2/37 for rows 1 through 15 and the zone punch for column 3, but is not ready to support an international proposal on a punched-card code representation at this time."

Motion passed Y (18) N (0) A (1)

2. Mr. C. E. Mackenzie moved that:

X3.2 take appropriate action to prepare Section A of the document X3.2/109 (revised X3.2/103) as the work program for ISO/TC97/SC4, and to prepare Section B as part of the work program for ISO/TC97/SC2.

3. Mr. C. E. Mackenzie moved that:

X3.2 take appropriate action to forward document X3.2/89 to ISO/TC97/SC4.

Motion passed Y (18) N (0) A (1)

Agenda Item #10 - Action on X3.2.4 Item

1. Mr. D. H. Kerr moved that:

We accept in principle the contents of Document X3.2/108, April 16, 1964 as a U. S. position.

Motion passed Y (14) N (1) A (0)

2. Mr. H. Spielman moved that:

In the code table proposed for submission in the international arena.

ACK be placed in column 1 row 8
EOB be placed in column 1 row 9
SS be placed in column 1 row 10
ES be placed in column 1 row 11
SOH be placed in column 0 row 1

Motion passed: Y (13) N (0) A (1)

3. Mr. D. A. Kerr moved that:

In the code table proposed for submission in the international area that position column 0 row 6 show both RU and CNCL (cancel) with a note indicating that this does not represent a proposed dual assignment but that one or the other will be subsequently recommended.

Motion passed: Y (14) N (1) A (2)

4. X3.2/111 was reviewed and modified.

The revised document X3.2/112 titled "Explanatory Remarks on Proposed Modifications of the ISO 7 Bit Control Function" was approved by the following motion:

Mr. J. Auwaerter moved:

That this paper be given to the delegation to SC2 for use at the May 1964 meeting as they see fit."

Motion passed: Y (19) N (0) A (0)

Agenda Item #11 - Action on X3.2.5 Item

1. Mr. W. H. McKenzie moved that:

X3.2 accept document X3.2/101 as the approach to development of a standard collating sequence.

Mr. C. E. Mackenzie moved that:

The following amendments be made to document X3.2/101:

Line 1 "enclose" be replaced by "endorse in principle"
Line 5 "shall be the binary" be replaced by "shall be equivalent to the binary"
Starting with line 6 "That is, the bit configuration..." be replaced by "That is the characters are to be regarded as proceeding from low (position 2,0) to high (position 5, 15)"

The amendments were approved: Y (19) N (0) A (0)
The original motion with the amended document passed:
Y (18) N (0) A (1)

2. Mr. W. H. McKenzie moved that:

The chairman of X3.2 forward the above endorsement to X3.4 and other interested parties.

Motion passed: Y (19) N (0) A (0)

3. Mr. C. E. Mackenzie moved that:

The program of work document X3.2/90 as amended be removed from the table.

Motion passed: Y (14) N (0) A (1)

Also that X3.2 approved the program of work

Motion passed: Y (16) N (0) A (0)

Agenda Item #13 - Action on X3.2.1 Items

Mr. J. E. Taunt moved that:

Document X3.2/105, X3.2.1 answer to General Services Administration Comment Request No. 5835-4-004-2, as amended be accepted by X3.2.

Motion passed: Y (19) N (0) A (1)

Agenda Item #14 - Review of position and proposed directions to delegate for May, 1964 International meeting.

1. Mr. J. Auwaerter indicated the delegation had the following possible courses of action.
 - a. Put the Second Draft Proposal (slightly modified) 6 and 7 bit codes out as a Draft Recommendation
 - b. Treat changes (reference X3.2/112) as:
 1. Subject of further work in SC2
 2. Subject of a Questionnaire within SC2 or
 3. Subject of a Third Draft Proposal

2. Mr. J. Auwaerter moved that:

The U. S. delegation to SC2 be instructed to work for advancing the Second Draft ISO Proposal 6 and 7 bit codes to Recommendation stage with such modifications as may be practical, and to work for the modifications stated in X3.2/112 as strongly as possible without delaying the circulation as draft Recommendations.

Mr. C. E. Mackenzie moved that:

The motion be amended to read:

The U. S. Delegation to SC2 be instructed to work for the modification stated in X3.2/112 as strongly as possible.

Amendment failed Y (2) N (16) A (1)

Mr. C. E. Mackenzie moved that:

The words "as strongly as possible without delaying the circulation as draft recommendation" be removed from the motion.

The amendment passed: Y (10) N (9) A (0)

Mr. J. B. Booth moved that:

The section of the motion which reads "practical, and to work for the modifications" be changed to read "practical, and consistent with the above to work for the modifications".

The amendment passed: Y (11) N (4) A (0)

Mr. R. Utman requested a point of clarification as to the meaning of "with such modifications as may be practical."

Mr. J. Auwaerter explained that "the modifications would not be of such an extent as to require a Third Draft Proposal".

Final motion as amended:

"The U. S. Delegation to SC2 be instructed to work for advancing the Second Draft ISO Proposal 6 and 7 bit codes to Recommendation stage with such modifications as may be practical and consistent with the above to work for the modifications stated in X3.2/112."

Motion passed: Y (16) N (2) A (0)

Recorded Vote

T. R. Bousquet	Yes
A. L. Whitman	Yes
E. F. Vidro, Jr.	Yes
J. K. Nelson	Yes
D. A. Kerr	Yes
M. Mendelsohn	Yes
E. A. Avakian	Yes (by Proxy - J. B. Booth)
J. F. Auwaerter	Yes
C. E. Schultheiss	Yes (by Proxy - J. F. Auwaerter)
R. F. Ewald	Yes
O. R. Arne	Yes
W. H. McKenzie	Yes
E. H. Clamons	No
R. M. Brown	Yes
C. E. Mackenzie	No
G. E. Mithoe	Yes
J. L. Little	Yes
R. E. Utman	Yes

Agenda Item #14.1 - Review of the Delegation to SC2

Mr. H. Spielman request to be removed from the delegation.

Mr. J. L. Little was then appointed as a delegte to SC2.

Action on the National Activity Report

Mr. J. F. Auwaerter requested that each of the X3.2 Task Group chairmen submit a paper to him and he will combine the papers into a National Activity Report.

June Meeting

The June meeting of X3.2 and its Task Groups will be held in Philadelphia, Pennsylvania.

The meeting adjourned April 17, 1964 at 4:45 p.m.

Respectfully submitted

Theodore R. Bousquet
Theodore R. Bousquet
Secretary, pro tem

ATTENDANCE - X3.2 MEETING #37 - APRIL 16-17, 1964

NAME	AFFILIATION	STATUS	APRIL 16	APRIL 17
T. R. Bousquet	Honeywell	M	X	X
L. L. Griffin	U. S. Navy	M	X	X
V. L. Thompson	UNIVAC	A	X	X
R. M. Brown	DOD	M	X	X
R. E. Mullendore	Bureau of Census	A	X	
E. J. Lewis	ITT/DISD	M	X	X
G. V. Hawkins	IBM	A	X	X
W. Y. Lang	BTL	M	X	X
J. F. Auwaerter	Teletype	M	X	X
C. E. Schultheiss	Burroughs	A & P	X	X
J. B. Booth	Teletype	A & P	X	X
G. E. Mithos	SCM	A	X	X
D. A. Kerr	BTL	A	X	X
H. M. Rathbun	Monroe	A	X	
E. F. Vidro, Jr.	Xerox	M	X	X
J. E. Taunt	G. E.	M	X	X
R. M. Muise	Honeywell	A	X	X
G. L. Murphy	Ampex	M	X	
C. E. Mackenzie	IBM	M	X	X
R. E. Utman	J. C. Penney	M	X	X
J. L. Little	NBS	M	X	X
H. Spielman	RCA	M	X	X
A. L. Whitman	ITT Comm. Sys.	M		X
H. L. Tholstrup	Friden	M	X	X
R. M. Gryb	A T & T	M	X	X
W. H. McKenzie	ITT/DISD	A	X	X
W. F. Huf	Navy	O	X	
J. K. Nelson	Western Union	M	X	X
E. S. Fergusson	Rockford Res. Inst.	O	X	
M. Cohen	NCR	A	X	X
E. H. Clamons	UNIVAC	M		X
P. G. Charest	Navy	O		X
W. J. Craven, Jr.	NAVCOSSACT	O	X	X
J. W. Sage	U. S. Army	O		X
M. Mendelsohn	Monroe	M		X
O. R. Arne	Mergenthaler Linotype	M		X

M = Member
A = Alternate
O = Observer
P = Proxy

EXPLANATORY REMARKS ON PROPOSED MODIFICATION OF THE ISO 7 BIT CODE CONTROL FUNCTIONS

Why Modifications Are Proposed

For the past year, Task Group X3.2.4 in close liaison with Task Group X3.3.4 (End-to-End Controls), has, in addition to considering decisions reached at international meetings, been faced with requests for changes in the control characters which included additions and redefinitions. As might be expected, the quantity of desired control characters, exceed the code positions available. The ESCAPE and ACK characters (presently assigned to Column 7 of the ASCII) were considered for assignment to Columns 0 and 1, in order to, with the exception of DEL (Delete), clear Column 7 for graphics.

After much preliminary screening and eliminating, there remained 36 control characters, including ACK and ESC, with worthwhile control function ability competing for the 32-code positions of Columns 0 and 1. This number was reduced to 35 characters when it was decided to restore ESC to its original position in Column 7, Row 14. The ACK character could not remain in Column 7, Row 12, because of action by ISO/TC97/SC2 in October, 1963, which assigned the lower case alphabet to Columns 6 and 7 and in so doing displaced the ASCII ACK by a national usage graphic character.

With the dilemma of fitting 35 functions (including ACK, five device controls, eight information separators, communication controls, format effectors, and Shift-Out and Shift-In) into the 32 code positions, it was obvious that a compromise had to be reached so that the 32 control characters agreed upon would provide maximum utility to the greatest number of users of the code; i.e., the code had to satisfy, as far as possible, the needs of the simple printer terminal and the more complex data processor. Further, all methods of information interchange had to be considered including transfer of media from one machine to another, and the many types of communication systems expected (such as circuit-switched, non-switched, or store-and-forward; two-point or multipoint; half-duplex or full duplex, etc.)

Studies indicated need for only four hierachial information separators. The start of special sequence and End of Special Sequence separator functions were determined to be of sufficient importance and general usage to warrant specific assignments. It was therefore decided to use two of the information separator code positions for more useful functions.

With two information separators removed there still remained 33 functions to fit into the 32 code positions. All communication controls, format effectors, shift-out and shift-in, the device controls, LEM, and the remaining separators were scrutinized to determine the control character function. It was suggested that the RU (Are You) character be removed from the code table since it is considered to have had a limited use.

CB1 67/1/12

The resulting code table, it is believed, contains the control characters possessing the maximum consolidation of non-conflicting control functions. The control character definitions, wherever possible, specify broad control functions to allow permissive use by the general user.

Table I contains a summary of suggested modifications to the Control Character portion of the Proposed ISO-7-Bit Code. Table 2 is the suggested control character code table for Columns 0 and 1 of the Proposed ISO 7-Bit Code. It was intended that the code positions of all proposed or modified control characters be on a "least change to present understanding" basis.

TABLE I

Proposed Modifications to the Control Character Portion of the Proposed
ISO 7-Bit Code

<u>Proposal</u>	<u>Reason</u>
Replace Error with NACK	Needed to make code more useful and effective in data communication.
Eliminate two Information Separators (IS ₀ and IS ₁)	Make Two code positions available for other assignment. Remaining Information Separators are sufficient for information interchange.
Add EOB (End of Block)	Needed to make code more useful and effective in data communication.
Move ACK (Acknowledge) to Column 1.	Assign new code position. Wide acceptance and general usage in data communication.
Assign SS (Start of Special Sequence) ES (End of Special Sequence), FS (File Separator), GS (Group Separator), RS (Record Separator), and US (Unit Separator).	Specific names add utility.
Redesignate SOM as SOH (Start of Heading)	To better specify purpose and use of this control character.
Redesignate EOA as STX (Start of Text)	To better specify purpose and use of this control character.
Redesignate EOM as ETX (End of Text)	To better specify purpose and use of this control character.
Redesignate WRU as INQ (Inquiry)	To better specify purpose and use of this control character.

NOTE: In addition, the following are under consideration:

<u>Proposal</u>	<u>Reason</u>
1. Eliminate RU	Considered to be a limited function.
2. Add CNCL (Cancel)	Needed to make code more useful and effective.

Table 2

PROPOSED CONTROL CHARACTER CODE TABLE

		Proposed		Present 7-bit ISO	
		000	001	000	001
		Col.			
Row		0	1	0	1
0000	0	NULL	DLE	TC ₀ (NULL)	DC ₀ (DLE)
0001	1	SOH	DC ₁	TC ₁ (SOM)	DC ₁
0010	2	STX	DC ₂	TC (EOA)	DC ₂
0011	3	ETX	DC ₃	TC (EOM)	DC ₃
0100	4	EOT	DC ₄ (STOP)	TC ₄ (EOT)	DC ₄ (STOP)
0101	5	INQ	NACK	TC ₅ (WRU)	ERROR
0110	6	RU CNCL	SYNC	TC ₆ (RU)	SYNC
0111	7	BELL	LEM	TC ₇ (BELL)	LEM
1000	8	BKSP	ACK	FE ₀ (BS)	IS ₀
1001	9	HT/SK	EOB	FE ₁ (HT)	IS ₁
1010	10	LF	SS	FE ₂ (LF)	IS ₂
1011	11	V TAB	ES	FE ₃ (VT)	IS ₃
1100	12	FF	FS	FE ₄ (FF)	IS ₄
1101	13	CR	GS	FE ₅ (CR)	IS ₅
1110	14	SO	RS	SO	IS ₆
1111	15	SI	US	SI	IS ₇

Note: The placement of RU and Cancel in one location does not indicate a dual assignment. Both are under consideration and at a later date, one will be selected. *recommended.*

COMMENTS ON PROPOSED MODIFICATION TO CONTROL CHARACTER
PORTION OF THE PROPOSED ISO 7-BIT CODE

I. COMMUNICATION CONTROLS

The names, abbreviations, and functional implications of control characters SOH, STX, ETX, EOT, INQ, DLE (DC₀), NACK, ACK and EOB are based on the work of ASA Task Group X3.3.4. Their work was accepted with minor modifications by ASA Task Group X3.2.4. The proposed changes including the resulting definitions and the reasons for each, are shown below.

A. Redesignate SOM as SOH (Start of Heading)

Start of Heading more fittingly describes the actual function performed by this control character.

Proposed Definition

"A character used in data communication to indicate the start of the heading which includes machine sensible routing information and may include other information such as precedence or security designation."

Remarks

SOH conditions receiving station(s) to react to the heading.
It may be omitted in systems which do not use a heading.
The heading is normally terminated by STX.

B. Redesignate EOA as STX (Start of Text)

The main function of STX is to indicate that text follows; it also terminates the heading.

Proposed Definition

"A character used in data communication to indicate the start of text or the start of a block of text (See EOB). It terminates the heading initiated by SOH."

Remarks

If no heading is used, STX may be the first character of a text. The text may include an inside address, precedence, security, or other supplementary information intended primarily for the end user, as opposed to similar information transmitted in the heading.

The use of STX in a message without a heading is consistent in that STX always indicates "text follows" SOH (if used) indicates "heading follows." The present term EOA is inappropriate to a message without a heading.

C. Redesignate EOM as ETX (End of Text)

The use of the term "text" avoids the ambiguity of the meaning of "message"; for example, one heading may serve several texts, a situation which makes the concept of "message" somewhat unclear. The term "text" does not carry the impression it contains a heading.

Proposed Definition

"A character used in data communications to indicate the end of text."

D. Redesignate WRU as INQ (Inquiry)

The WRU character definition presently allows its use only for station identification. It is recommended that the definition be broadened to permit other necessary functions, such as the status of a particular ancillary device which may be non-conflicting in a given system. The more broadly defined INQ character may be used to request such responses.

Proposed Definition

"A character used in data communication as a request for a response from a remote station. INQ may be used as a "Who are you?" to obtain a station identification (if provided)."

Remarks

INQ might be used during transmission to call for a repeat transmission of a response in the event that a response is not received when expected.

E. Need for DLE (Data Link Escape)

The character DLE is envisioned as a means of providing additional control functions for data communication. These control functions, having primarily a link-by-link significance, are contrasted with "end-to-end" control functions. The latter must not conflict with link control and additional "end-to-end" control functions may be achieved through the use of the ESCAPE character.

Proposed Definition

See page 12.

F. Move ACK to Column 1

There is need in data communications systems for a machine generated positive response character (ACK) in addition to a "graphic response" that may be used as a visual indication of an affirmative response. The ACK character is needed for use as an affirmative response for error checking answerback, terminal addressing answerback, and ancillary device control answerback.

Proposed Definition

"The ACK character in data communications is generated at a receiving device to indicate to the sending device that: (a) connection has been established; (b) information has been received successfully."

G. Add NACK (Negative Acknowledge)

In addition to the need for an affirmative response signal (ACK) there is also a requirement in data communication system for a negative response signal (NACK). The NACK character is machine generated as a negative response for error checking answerback, terminal addressing (or ancillary device addressing) answerback and terminal polling answerback. This is one of two possibly conflicting functions formerly attributed.

Proposed Definition

"A character used in data communication to be transmitted by a receiving station as a negative response to the sender."

H. Add EOB (End of Block)

An "End of Block" (EOB) control character is required to allow subdivision of texts into "blocks" of data for error checking and other control purposes. Note that these "blocks" of data could be a line of print or one punched card, and may well be independent of the "information separators" inserted in the data stream.

Proposed Definition

"A character used in data communication to indicate the end of a block in systems that divide information for transmission."

II. INFORMATION SEPARATORS

A. Number of Information Separators

Experience with the processing of large volumes of data, including the processing of communication data, has demonstrated a need for a plurality of information separators. In the initial ISO 7-bit code assignment, eight Information Separators were allocated for this purpose.

Current thinking indicates that the assignment of eight information separators is not justified in the face of other requirements on the code table.

The four separators (FS, GS, RS, and US) were placed in code positions IS₄, IS₅, IS₆, and IS₇, respectively, to provide a group contiguous with the word separator SPACE.

B. Assign SS (Start of Special Sequence) and ES (End of Special Sequence)

Review of existing systems has demonstrated the need for special Information Separators exclusive of the US, RS, GS, and FS to delimit extra ordinary sequences of data characters.

III. Other Considerations

The following actions have been suggested but are not yet formally proposed. Further study is being given to the matter.

- A. Consideration is being given to the elimination of RU from the code table since it is considered to have a limited use.
- B. Add CNCL (Cancel)

Forward-acting as well as backward-acting single-character control functions are needed for error control. In the present proposed ISO 7 bit code table, it is not clear whether the ERR (Error) character serves one or both of these purposes. For classification it is proposed that the backward-acting function be given the name NACK, and the forward-acting function be designated CNCL (Cancel). It remains to be resolved whether:

- (a) CNCL should mean an error exists in the data in which it is associated, or
- (b) CNCL substitutes for a character known to be in error, or
- (c) Both a and b

PROPOSED CONTROL CODE DEFINITIONS

TC₀ NULL

The all zeros character which may serve to accomplish:

- a. Time fill
- b. Media fill

TC₁ SOH (Start of Heading) (For SOM)

A character used in data communications to indicate the start of the heading which includes machine sensible routing information and may include other information such as precedence or security designations.

TC₂ STX (Start of Text) (For BOA)

A character used in data communication to indicate the start of text or the start of a block of text (see EOB). It terminates any heading initiated by SOH.

TC₃ ETX (End of Text) (For EOM)

A character used in data communication to indicate the end of Text.

TC₄ EOT (End of Transmission)

A character used in data communication which indicates the end of a transmission. A transmission may include one or more tests.

TC₅ INQ (Inquiry) (For WRU)

A character for use in data communication as a request for a response from a remote station. INQ may be used as a "Who Are You?" to obtain a graphic station identification (if provided).

TC₆ CNCL (Cancel) (if included)

(Not yet defined)

RU (Are You?) (if retained)

See X3.2/77

A request for a station to indicate if it is the station whose identification immediate follows the RU character.

TC₇ BELL

The BELL character is for use when there is need for human attention and may be used to produce an appropriate signal.

FE₀ BKSP (Backspace)

On a printing device, the Backspace character causes the printing point to move one character position to the left relative to the printable surface.

FE₁ HT/SK (Horizontal Tab/Skip)

Horizontal Tabulate - On a printing device, the HT/SK character causes the printing point to move to the right, relative to the medium, to the next one of a number of predetermined positions.

Skip - On a card handling device, the HT/SK character causes the reading or recording point to move to the right, relative to the medium, to the next one of a number of predetermined positions.

FE₂ LF (Line Feed)

On a page printing device, the LF character causes the printing point to move down, relative to the page, to the next line.

FE₃ VT (Vertical Tab)

On a page printing device, the VT character causes the printing point to move down, relative to the page, to the next one of a number of predetermined positions.

FE₄ FF (Form Feed)

On a page printing device, the FF character advances the medium, causing the next form to move into the proper position for printing.

FE₅ CR (Carriage Return)

In a page printing device, the CR character causes the printing point to return to the left-hand margin of the same printing line.

SO (Shift Out)

The Shift-Out Character means that the graphic bit patterns which follow may have alternate interpretations until a Shift-In Character is reached. (It may later be found desirable to specify the effects of Shift-Out on the meaning of control characters.)

SI (Shift In)

The Shift-In Character means that all the bit patterns which follow shall be interpreted according to the code table.

DC₀

DLE (Data Link Escape)

A character used in data communication as a means of code extension to obtain additional link control functions. It is the first character of a multiple character sequence which represents such a function.

DC₁

(Device Control 1)

DC₂

(Device Control 2)

DC₃

(Device Control 3)

Functional characters for the control of ancillary devices associated with data processing or tele-communication systems, more specifically intended for the switching of devices "on" or "off."

DC₄

(Stop)

This device control character is used to interrupt or turn off ancillary devices.

NACK (Negative Acknowledge) (For ERR)

A character used in data communication to be transmitted by a receiving station as a negative response to the sender.

SYNC (Synchronous Idle)

A character transmitted by a synchronous transmission system in the absence of any other character to provide a signal from which synchronism may be achieved or retained.

LEM (Logical End of Medium)

A functional character which identifies the end of information recorded, or to be read, on a unit of physical material, such as a card or length of tape. This character is not necessarily located at the physical end of the recording material.

ACK (Acknowledge) (For IS₀)

The acknowledge character in data communication is generated at a receiving station to indicate to the sending station that:

- a. A connection has been established.
- b. Information has been received successfully.

EOB (End of Block) (For IS₁)

A character used in data communication to indicate the end of a block in systems that divide information for transmission.

SS (Start of Special Sequence) (For IS₂)

A character which is used to indicate the start of a variable length sequence of characters which have special significance or which are to receive special handling. The end of this sequence is indicated by ES, "End of Special Sequence."

ES (End of Special Sequence) (For IS₃)

A character which is used to indicate the end of a special sequence started by SS, "Start of Special Sequence."

ESC (Escape)

A conditioning character which will change the meaning of one or more of the bit patterns which follow. It is intended to provide supplementary characters in general information interchange.

DEL (Delete)

This character is used primarily to "erase" or "rub out" erroneous or unwanted characters in punched tape.

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I S O

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
TECHNICAL COMMITTEE ISO/TC 97
COMPUTERS AND INFORMATION PROCESSING

Subcommittee 2 -- Character Sets and Coding

ISO/TC 97/SC 2 (N.Y.'64-18) 123* E
May 20, 1964

REVISED TECHNICAL CONTENTS
TO BE INCLUDED INTO
A THIRD DRAFT PROPOSAL
ON ISO
6 BIT AND 7 BIT CODES

Introduction

6 Bit Set Table

7 Bit Set Table

Explanatory Notes About the Tables

Legend 1-Controls
 2-Graphics

Explanatory Comments on the Code Tables

This document incorporates document 117 and document 118
as amended by the SC 2 meeting on May 15, 1964.

CB1 67/1/12

INTRODUCTION

Subject

1. This Recommendation defines two character sets for general usage, including letters, figures, punctuation marks, special symbols and controls, with their coded representation.
2. The requirements for graphics and controls in data handling and programming, in accordance with computer and ancillary equipment characteristics, have been taken into account in determining these character sets.
3. This Recommendation essentially consists of two tables, complemented by notes, legend and comments.

Scope

1. These coded character sets are primarily for the interchange of information among data processing systems and associated equipment. They may be regarded as basic alphabets in the abstract sense.
2. These coded character sets are applicable to all so-called latin alphabets.
3. Each coded character in one set consists of six bits and in the other set, of seven bits. One coded character set contains 6-bit characters and provides 64 coded characters, the other contains 7-bit characters and provides 128 coded characters. The two sets are compatible in that they are logically related. This facilitates the conversion between the two sets.

Implementation

1. These basic alphabets may be implemented in various media with logically related codes, as appropriate. For example, this could include transmission channels, punched tape and magnetic tape, and thus permit interchange of data to take place either indirectly by means of an intermediate recording in a continuous physical medium, or by local electrical connection of various units (such as input and output devices and computers) or by means of data transmission equipment.
2. The means of encoding these character sets for transmission, for recording on physical media, and taking into account the need for error checking should be the subject of future ISO Recommendations.

Caractères codés pour l'échange d'information entre matériels de traitement de l'information

Character codes for Information processing interchange

TABLEAU DE CODE A 6 ÉLÉMENTS D'INFORMATION

6 BIT SET TABLE

						Column				
						0	0	1	1	
						0	1	0	1	
						0	1	2	3	
Bits	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	Row			
	0	0	0	0	0	0	F ₀ Space	0	Null	P
	0	0	0	1	1	1	F ₁ (HT)	1	A	Q
	0	0	1	0	2	2	F ₂ (LF) ①	2	B	R
	0	0	1	1	3	3	F ₃ (VT)	3	C	S
	0	1	0	0	4	4	F ₄ (FF)	4	D	T
	0	1	0	1	5	5	F ₅ (CR) ①	5	E	U
	0	1	1	0	6	6	SO	6	F	V
	0	1	1	1	7	7	SI	7	G	W
	1	0	0	0	8	8	(	8	H	X
	1	0	0	1	9	9	)	9	I	Y
	1	0	1	0	10	10	*	: ②	J	Z
	1	0	1	1	11	11	+	; ②	K	([) ③
	1	1	0	0	12	12	,	< ②	CS ₁	L (CS ₂) ③
	1	1	0	1	13	13	-	= ④	%	M ([) ③
	1	1	1	0	14	14	.	>	&	N Esc
	1	1	1	1	15	15	/	'	0	Def

les chiffres encadrés ② à ④ renvoient à des notes explicatives figurant à la page B4

circled numerals ① through ④ refer to explanatory notes on page B4

TABLEAU DE CODE A 7 ÉLÉMENTS D'INFORMATION

7 BIT SET TABLE

les chiffres encadrés (1) à (8) renvoient à
les notes explicatives figurant à la page 5
ISO/TC 97/SC 2 (Secretariat) F/E
(NY 64-18) 123

~~November 1963~~
May 1964

EXPLANATORY NOTES ABOUT THE TABLES

Notes relating to the 6 bit set:

1. The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line.

For equipment which uses a single combination (called New Line) for a combined carriage return and line feed operation, NL will be coded at F2. This requires agreement between the sender and the recipient of the data. F5 will then be regarded as Backspace (BS).

2. If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of "colon" (:) and "semi-colon" (;) respectively.
3. "Reserved for National Use". These positions are primarily intended for alphabetic extensions. If they are not required for that purpose they may be used for symbols and the recommended choice is shown in parentheses.
4. Either of the two sets of symbols shown in these positions in the table may be chosen; but this requires agreement between the sender and the recipient of the data.

Notes relating to the 7 bit set:

1. The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line.

For equipment which uses a single combination (called New Line) for combined carriage return and line feed operation, NL will be coded at FE 2. The use of New Line requires agreement between the sender and the recipient of the data.

2. If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of "colon" (:) and "semi-colon" (;) respectively.
3. "Reserved for National Use". These positions are primarily intended for alphabetic extensions. If they are not required for that purpose, they may be used for symbols and the recommended choice as shown in parenthesis.
5. "Reserved for National Use." A currency sign will be assigned to this position.
6. The number sign (#) in position 2/3 may have an alternate graphical representation (N^o).
7. It is acceptable to represent tilde (~) by circumflex (^) for international interchange of information in Spanish and Portuguese. In Spanish and Portuguese speaking countries the tilde may replace the circumflex in position 5/14.
8. The graphics in positions 2/2, 2/7, 5/14 have the significance of quotation mark, apostrophe and upwards arrow, respectively; however, these characters take on the significance of diaeresis, acute accent and circumflex diacritical signs when they follow the Backspace code.

1. Controls

<u>Ack</u>	-	Acknowledge
<u>Bell</u>	-	Alarm or attention signal
<u>BS</u>	-	Backspace
<u>Cncl</u>	-	Cancel
<u>CR</u>	-	Carriage Return
<u>DC</u>	-	Device Control
<u>Del</u>	-	Delete
<u>DLE</u>	-	Data Link Escape
<u>EM</u>	-	End of Medium
<u>Enq</u>	-	Enquiry
<u>EOT</u>	-	End of Transmission
~~ES~~ <i>OUT</i>	-	End of Special Sequence
<u>Esc</u>	-	Escape
<u>ETB</u>	-	End of Transmission Block
<u>ETX</u>	-	End of Text
<u>F</u>	-	Function
<u>FE</u>	-	Format Effector
<u>FF</u>	-	Form Feed
<u>FS</u>	-	File Separator
<u>GS</u>	-	Group Separator
<u>HT</u>	-	Horizontal Tabulation
<u>IS</u>	-	Information Separator
<u>LF</u>	-	Line Feed
<u>Nack</u>	-	Negative Acknowledge
<u>Null</u>	-	Null

<u>RE</u>	-	Record Separator
<u>SI</u>	-	Shift-in
<u>SO</u>	-	Shift-out
<u>SOH</u>	-	Start of Heading
<u>Space</u>	-	Space
<u>SS</u>	-	Start of Special Sequence
<u>Stop</u>	-	Stop
<u>STX</u>	-	Start of Text
<u>Sync</u>	-	Synchronous Idle
<u>TC</u>	-	Transmission Control
<u>US</u>	-	Unit Separator
<u>VT</u>	-	Vertical Tabulation

2. Graphical symbols

Position in the code tables		Names	
<u>6-Bit</u>	<u>7-bit</u>		
0/0	2/0	Space	A normally non-printing graphic character used to separate words
-	2/1	!	Exclamation mark
-	2/2	"	Diaeresis Quotation mark (see footnote)
-	2/3	#	Number sign
-	2/4	CS	First currency symbol
1/13	2/5	%	Percent
1/14	2/6	&	Ampersand
1/15	2/7	'	Acute accent apostrophe (see footnote)
0/8	2/8	(	Left parenthesis
0/9	2/9	)	Right parenthesis
0/10	2/10	*	Asterisk
0/11	2/11	+	Plus sign
0/12	2/12	,	Comma
0/13	2/13	-	Hyphen, minus sign
0/14	2/14	.	Full stop (period)
0/15	2/15	/	Solidus
1/10	3/10	:	Colon
1/11	3/11	;	Semi-colon
1/12	3/12	<	Less than
1/13	3/13	=	Equals
1/14	3/14	>	Greater than
1/15	3/15	?	Question mark
-	4/0		Underline
3/11	5/11	[	Left square bracket
3/12	5/12	CS ₂	Second currency symbol
3/13	5/13	]	Right square bracket
-	5/14	^	Circumflex accent, upwards arrow (see footnote)
-	5/15	`	Grave accent (see footnote)
-	6/0	@	Commercial At

Footnote: The use of these symbols as diacritical signs is described in section 2 of the explanatory comments on the code tables.

1. Numbering of the positions in the code tables

Within any one character the bits are identified by $b_7 \dots b_1$, where b_7 is the highest order, or most significant bit, and b_1 is the lowest order, or least significant bit.

If desired these may be given a numerical significance in the binary system, thus:

Bit number	b7	b6	b5	b4	b3	b2	b1
Significance	64	32	16	8	4	2	1

In the code tables the columns and rows are identified by numbers written in binary and decimal notations.

Any one position in the code table may be identified in one of two ways, thus, taking as an example numeral 1 in the 7-bit code table:

- As its bit-pattern, e.g. 011 0001
- By its column and row numbers, e.g. 3/1

2. Diacritical Signs

It is proposed that certain printing symbols should be designed so that they may be used to permit the composition of accented letters when necessary for general interchange of information. A sequence of characters comprising a letter, the backspace and one of these symbols is needed for this composition, and the symbol is then regarded as a diacritical sign. It should be noted that these symbols take on their diacritical significance only when they follow the backspace code; for example, the symbol corresponding to the code combination 2/7 (") normally has the significance of apostrophe, but becomes the diacritical sign "acute accent" when preceded by the backspace.

In order to increase efficiency, it is possible to introduce accented letters (as single characters) in the positions in the code tables marked by note 3.

Furthermore, according to national requirements, these positions may contain special diacritical signs, such as cedilla (¸), "hacek" (ˇ) or (˘).

3. Functional Characteristics related to Control Characters

1. Generalized Controls

Many of generalized controls TC, FE, DC, IS, and F, have specific meanings which are shown against them, in parentheses, in the code tables. Their names, which are listed in paragraph 3.2, have been chosen from the terminology used for telecommunication and character-by-character printer equipment. In other types of equipment, different but related meanings may be associated with certain of the generalized controls, but this requires agreement between sender and

recipient of data.

Generalized controls are designated by a specific name followed by a number.

They are defined as follows:

TC - Transmission Control - A functional character intended to control or facilitate transmission of information over telecommunication networks.

FE - Format Effector - A functional character which controls the layout or positioning of information in Input/Output media.

DC - Device Control - A functional character for the control of ancillary devices associated with data processing or telecommunication systems, more especially switching devices "on" or "off".

- An example of how device control characters could be used in a specific tape system employing two ancillary tape punches and one ancillary tape reader is as follows:

DC 1 - First Punch "On"
DC 2 - Second Punch "On"
DC 3 - Tape reader "On".

IS - Information Separator - A character which is used to separate and qualify information in a logical sense. There is a group of four such characters, which are intended to be used in a hierarchical order.

F - Function - A functional character which, in the 6-bit set, may have the combined or alternative meanings of IS or FE.

3.2 Specific controls

In the table, these controls are specifically designated by a name or an abbreviation.

They appear either alone, e.g. SC, SI, or in parentheses, associated with a generalized control character.

They are defined as follows:

Ack - Acknowledge - A Transmission Control character that is generated at a receiving device to indicate to the sending device that:

- (a) A correct connection has been established,
- or (b) Data has been received successfully.

Bell - Bell - A character for use when there is a need to call for human attention; it may control alarm or attention devices.

- BS - Backspace - A layout character which controls the movement of the printing position one printing space backward on the same printing line.
- Cncl - Cancel - A character used to indicate that the data with which it is associated is in error or is to be disregarded.
- CR - Carriage Return - A layout character which controls the movement of the printing position to the first printing position on the same printing line.
- Del - Delete - This character is used primarily to "erase" or "obliterate" erroneous or unwanted characters in punched tape.
- DLE - Data Link Escape - A Transmission Control character which will change the meaning of the next single following code combination. It is used exclusively to provide supplementary control in data transmission networks.
- EM - End of Medium - A control character which may be used to identify the physical end of the medium, or the end of the used, or wanted portion, of information recorded on a medium. The position of this character does not necessarily correspond to the physical end of the medium.
- Enq - Enquiry - A Transmission Control character reserved for use in data communication systems as a request for a response from a remote station. The response may include station identification and/or station status.
- EOT - End of Transmission - A Transmission Control character used to indicate the conclusion of the transmission of one or more texts (every one of which must be terminated by ETX.)
- ~~ES~~ 007 - End of Special Sequence - A character which is used to indicate the end of a special sequence started by SS, "Start of Special Sequence."
- Esc - Escape - A functional character which may be used for an extension of the standard character set of the code by changing the meaning of the next single following code combination. The precise meaning of this following character requires prior agreement between the sender and the recipient of the data. The Escape character itself may therefore be regarded as a warning or non-locking shift character affecting the next single following character. The single character which follows Escape may be interpreted as a graphic or control character not included in the standard set.

Alternatively the meaning of this single character may be "Go into Code X and stay in it."

Used in this way this sequence of two characters has the effect of causing a locking shift to occur.

- ETB - End of Transmission Block - A Transmission Control character used to indicate the end of a block of data for transmission purposes. This character may be added to or deleted from a character sequence at any point in the data flow path without altering the interpretation of data. ETB is used for blocking data where the block structure has no necessary relationship with the processing format.
- ETX - End of Text - A Transmission Control character used to terminate a sequence of characters started with STX and transmitted as an entity. In systems employing error-control, there is a possibility that the error-control character(s) may follow ETX.
- FF - Form Feed - A layout character which controls the movement of the printing position to the first predetermined printing line on the next form.
- FS - File Separator (See IS for definition)
- GS - Group Separator (See IS for definition)
- HT - Horizontal Tabulation - A layout character which controls the movement of the printing position to the next in a series of predetermined positions along the printing line.
- IS - Information Separator - There are four information separators (FS, GS, RS, US) which have a hierarchical relationship with each other. They are related, progressing from the least to most powerful as follows: unit separator (US), record separator (RS), group separator (GS), and file separator (FS). (FS) is the most powerful separator.
- A "unit" cannot include a "file," "group," or "record."
- A "record" may include (and if it includes, it includes completely) a variable number (none, one or more) of "units."
A record cannot include "file" or "group."
- A "group" may include (and if it includes it includes it completely) a variable number (none, one, or more) of "records" and/or "units." A "group" cannot include a "file."
- A "file" may include, (and if it includes it includes completely), a variable number (none, one, or more) of "groups", "records," and/or "units."
- LF - Line Feed - A layout character which controls the movement of the printing position to the next printing line.
- Nack - Negative Acknowledge - A Transmission Control character transmitted by a receiver as a negative response to the sender.
- NL - New Line - A layout character which controls the movement of the printing position of the first printing position of the next printing line.

- Null - Null - A character which may be inserted into or removed from a stream of data without affecting the information content of that stream. Some forms of transmission systems may not be able to accept the use of this character.
- RS - Record Separator - (See IS for definition)
- SI - Shift-In - The shift-in character means that all the code combinations which follow shall be interpreted according to the standard code table.
- SO - Shift-Out - The shift-out character means that all the code combinations which follow shall be interpreted as outside of the character set of the standard code table until a shift-in character is reached.
- SOH - Start of Heading - A Transmission Control character used at the beginning of a sequence of characters which comprise a machine-sensible address or routing information. Such a sequence is referred to as the heading.
- Space- Space - A normally non-printing graphic character used to separate words. It is also a layout character which controls the movement of the printing position, one printing position in the forward direction.
- SS - Start of Special Sequence - A character which is used to indicate the start of a variable length sequence of characters which have special significance or which are to receive special handling. This SS may be used for transmission control purposes (see ES).
- Stop - Stop - This device control character is used to interrupt or "turn off" ancillary devices.
- STX - Start of Text - A Transmission Control character which precedes a sequence of characters that is to be treated as an entity and entirely transmitted through to the ultimate destination. Such a sequence is referred to as text. STX may be used to terminate a sequence of characters started by SOH.
- Sync - Synchronous Idle - A Transmission Control character used by a synchronous transmission system in the absence of any other character (Idle condition) to provide a signal from which synchronism may be achieved or retained.
- US - Unit Separator - (See IS for definition).
- VT - Vertical Tabulation - A layout character which controls the movement of the printing position to the next of a series of predetermined printing lines.

X3.2/123
May 26, 1964

BRIEF REPORT
of Meetings Held by
TC 97; 97/SC 2; 97/SC 4; 95/SC 8; 53D
in New York, May 1964

11-
May 15
According to draft

As a result of the subject meetings the following actions were taken:

1. Agreement was reached on a revised code table which changed the names of the transmission controls (to those recommended by the USA), reduced the number of Information Separators to four and placed new controls in the following positions:

ACK	in position	0/6 (col./row)
NACK	" "	1/5
ETB*	" "	1/7
CNCL	" "	1/8
EM**	" "	1/9
ES	" "	1/10
ESC	" "	1/11

*End of Transmission Block
**End of Medium

In addition, the underline was put in position 4/0 as an international standard, while the @ was moved to a preferred national choice position 6/0. Also positions 5/11-13 and 7/11-14 were confirmed for national usage, with position 5/12 preferred for a second currency sign.

2. A document based on the above agreement will be circulated as a Third Draft Proposal and, if the vote is positive, be processed directly as a draft ISO Recommendation without reference back to the Subcommittee.
3. It was agreed to circulate for comment a draft Proposal on Recorded Magnetic Tape. This draft will be consistent with USA recommendations.
4. It was agreed to circulate for ballot and comment a draft proposal on perforated tape coding, and if the vote is positive to process the document directly as a draft ISO Recommendation without reference back to the Subcommittee.
5. Agreement in principle on a punched card encoding, including a majority in favor of the use of the "no punches" condition for word separator, will be the subject of a report to be circulated for comment and further proposal.

2004 310/5

6. It was agreed to send out for letter ballot a draft Proposal on Unrecorded Magnetic Tape. The document will be generally consistent with the U.S. point of view.
7. A draft proposal on the dimensions of 1" perforated tape will be circulated for ballot and comment. This document presents a number of choices on the tolerances on physical dimensions.
8. Subcommittee 4 agreed to prepare and circulate a report on the physical dimensions of punched cards. While generally able to agree on nominal dimensions, and issue with respect to tolerances on physical dimensions on card length and width could not be resolved. Comments will be invited.
9. It was agreed to change the status of the Working Group on Numerical Control to Subcommittee 8 with France as Secretariat. The new group is to consider the advisability of enlarging its scope to include other aspects of numerical control of industrial processes.
10. It was agreed to develop a standard code for the numerical control of machine tools based as far as possible on the ISO 7 bit code.
11. Technical Committees 95 and 97 agreed to consolidation of work on input/output media and equipment in TC 97/SC 4 under the Italian Secretariat, subject to agreement by the IEC Committee of Action. The Italian Secretariat will set up four working groups, one on each of the principal media and one on I/O equipment and submit a proposed scope to TC 97 for comment.


J. F. AUWAERTER
X3.2 International Representative